Lab 5 – Memory and Mobile Device Forensics

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Introduction

Volatility is an open-source memory forensics framework for incident response and malware analysis. It is written in Python and supports memory dumps from all major 32- and 64-bit Windows versions and service packs including XP, 2003 Server, Vista, Server 2008, Server 2008 R2, and Seven. This tool introduces people to the techniques and complexities associated with extracting digital artifacts from volatile memory image.

Property List files, or more commonly known as plist files, are basically Mac application specific preference files. They contain information and settings for various applications and are usually in the easily identifiable format of com.developer.Application.plist and located within the /Library/Preferences/ directories at the system and user level. Plist Editor is a tool that can help investigators to read and edit both XML and binary format plist files.

SQLitespy is a software library that provides a relational database management system. It is easy to use, in terms of setup, database administration, and required resource. SQLite has the following noticeable features: self-contained, serverless, zero-configuration, transactional.

Wireshark is one of the most famous tools that is used to monitor network traffic and protocols used. It lets us monitor the network at a microscopic level, both wired and wireless.

In this lab we will examine a basic disk image for any suspicious processes running. We will also examine the image to find more information in general, the was any forensic investigator would be using Volatility. Later in the lab we will examine iPhone data for any stored passwords/ credentials, we will also examine the database to extract any useful and relevant information using Plist and SQLlitespy. In the last part of the lab we will examine the networks part of the data, i.e., using Wireshark.

1. Memory Forensics with Volatility

1. Were there any processes running on this computer that were hidden?

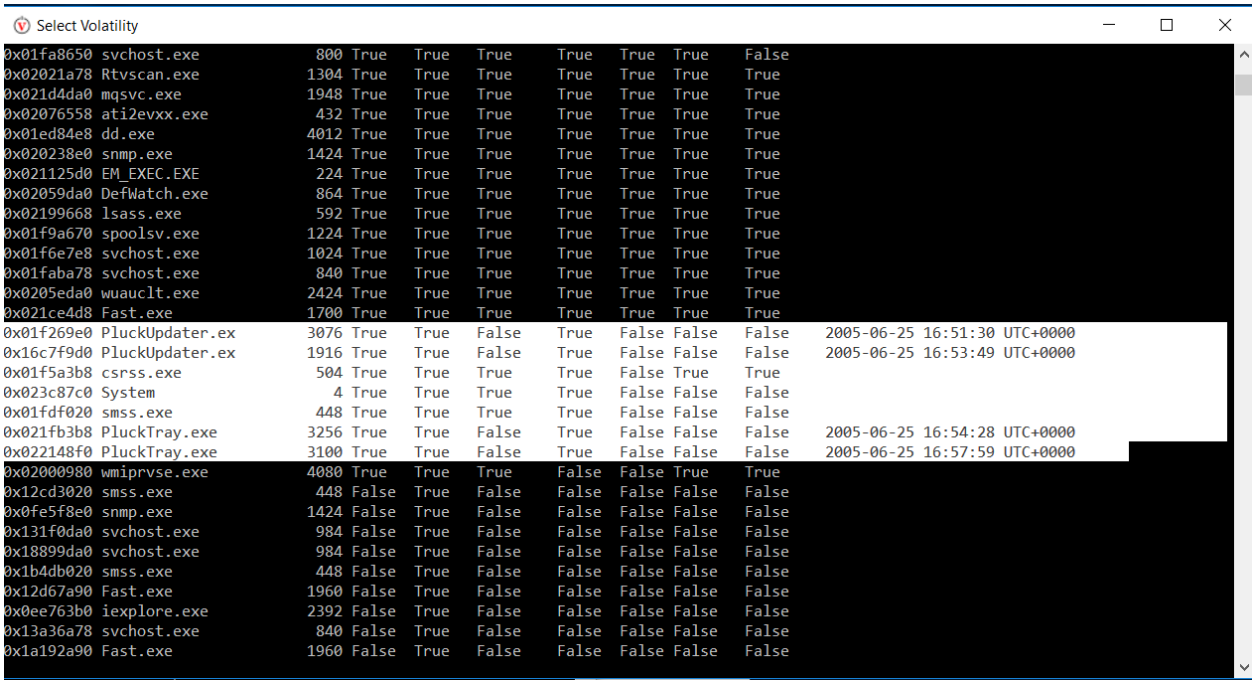
   Hidden processes: PluckUpdater.exe and PluckTray.exe

   Command used: volatility.exe -f E:\Memory Forenscis\xp-laptop-2005-06-25.img --profile WinXPSP2x86 psxview

   -f: this used to specify the filename to use when opening the image

   --profile: this is used to specify the profile to load, in this case the profile is WinXPSP2x86 which define WindowsXP Service Pack 2 32bit OS.

   psxview: this is used to find hidden processes with various process listings. Here hidden process means the process that are not typically seen in task manager. This could be because the malware was able to dereference the process, i.e., remove the node that point to the running process. This doesn't kill the process but enable it run without being seen by the user. To view this using psxview we need to focus on *thrdproc* and *pspcid* which means the reference to process has been removed.



Select Volatility

0x01fa8650	svchost.exe	800	True	True	True	True	True	True	False	
0x02021a78	Rtvscan.exe	1304	True	True	True	True	True	True	True	
0x021d4da0	mqsvc.exe	1948	True	True	True	True	True	True	True	
0x02076558	ati2evxx.exe	432	True	True	True	True	True	True	True	
0x01ed84e8	dd.exe	4012	True	True	True	True	True	True	True	
0x020238e0	snmp.exe	1424	True	True	True	True	True	True	True	
0x021125d0	EM_EXEC.EXE	224	True	True	True	True	True	True	True	
0x02059da0	DefWatch.exe	864	True	True	True	True	True	True	True	
0x02199668	lsass.exe	592	True	True	True	True	True	True	True	
0x01f9a670	spoolsv.exe	1224	True	True	True	True	True	True	True	
0x01f6e7e8	svchost.exe	1024	True	True	True	True	True	True	True	
0x01faba78	svchost.exe	840	True	True	True	True	True	True	True	
0x0205eda0	wuauclt.exe	2424	True	True	True	True	True	True	True	
0x021ce4d8	Fast.exe	1700	True	True	True	True	True	True	True	
0x01f269e0	PluckUpdater.ex	3076	True	True	False	True	False	False	False	2005-06-25 16:51:30 UTC+0000
0x16c7f9d0	PluckUpdater.ex	1916	True	True	False	True	False	False	False	2005-06-25 16:53:49 UTC+0000
0x01f5a3b8	csrss.exe	504	True	True	True	True	False	True	True	
0x023c87c0	System	4	True	True	True	True	False	False	False	
0x01fdf020	smss.exe	448	True	True	True	True	False	False	False	
0x021fb3b8	PluckTray.exe	3256	True	True	False	True	False	False	False	2005-06-25 16:54:28 UTC+0000
0x022148f0	PluckTray.exe	3100	True	True	False	True	False	False	False	2005-06-25 16:57:59 UTC+0000
0x02000980	wmiprvse.exe	4080	True	True	True	False	False	True	True	
0x12cd3020	smss.exe	448	False	True	False	False	False	False	False	
0x0fe5f8e0	snmp.exe	1424	False	True	False	False	False	False	False	
0x131f0da0	svchost.exe	984	False	True	False	False	False	False	False	
0x18899da0	svchost.exe	984	False	True	False	False	False	False	False	
0x1b4db020	smss.exe	448	False	True	False	False	False	False	False	
0x12d67a90	Fast.exe	1960	False	True	False	False	False	False	False	
0x0ee763b0	iexplore.exe	2392	False	True	False	False	False	False	False	
0x13a36a78	svchost.exe	840	False	True	False	False	False	False	False	
0x1a192a90	Fast.exe	1960	False	True	False	False	False	False	False	

2. What is the username of the primary user on this computer?

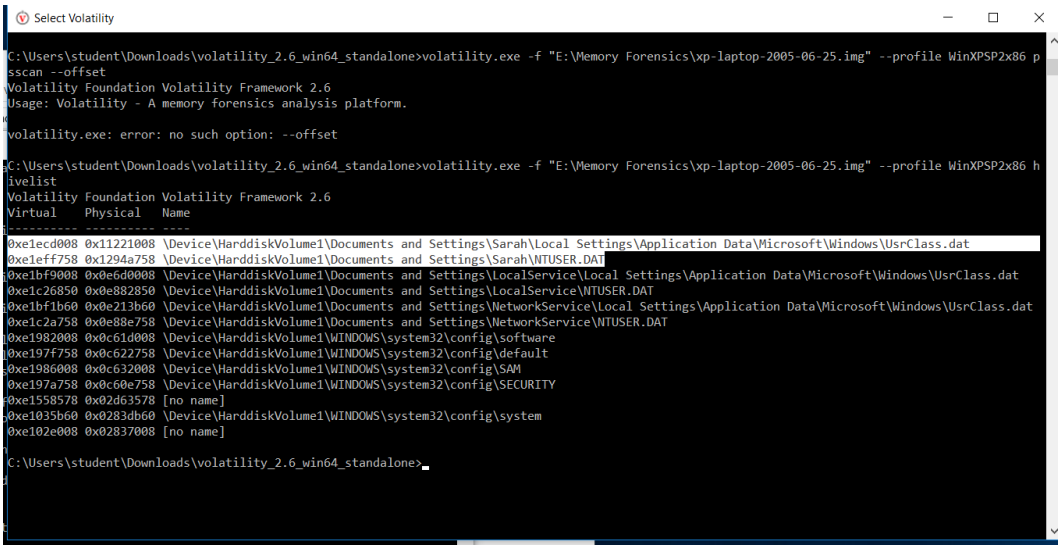
   The primary username is Sarah.

   Command used: volatility.exe -f E:\Memory Forenscis\xp-laptop-2005-06-25.img --profile WinXPSP2x86 psxview

   -f: this used to specify the filename to use when opening the image

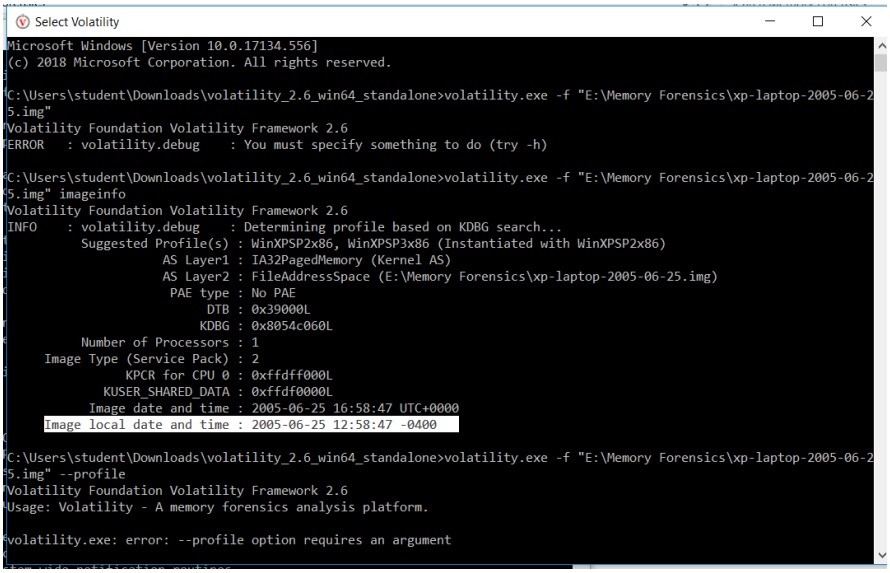
   --profile: this is used to specify the profile to load, in this case the profile is WinXPSP2x86 which define WindowsXP Service Pack 2 32bit OS.

   hivelist: prints the list of registry hives.



3. What is the system time?

   The local time zone is EDT we can figure this out from the -0400 after local time.



4. What browser(s) were running?

   The two browsers in that we get from using psscan, a pool scanner for all process objects, are Explorer and Firefox

```
0x0000000001f5f020 ssonsvr.exe        1632   1580 0x12b3f000 2005-06-25 16:47:46 UTC+0000
0x0000000001f67500 TaskSwitch.exe     1952   1812 0x139d2000 2005-06-25 16:47:48 UTC+0000
0x0000000001f68518 Crypserv.exe        688    580 0x14a49000 2005-06-25 16:47:55 UTC+0000
0x0000000001f6ca90 Fast.exe           1960   1812 0x13aaf000 2005-06-25 16:47:48 UTC+0000
0x0000000001f6db28 msdtc.exe          1076    580 0x14b6f000 2005-06-25 16:47:55 UTC+0000
0x0000000001f6e7e8 svchost.exe        1024    580 0x1043e000 2005-06-25 16:47:35 UTC+0000
0x0000000001f8dda0 svchost.exe         984    580 0x10220000 2005-06-25 16:47:35 UTC+0000
0x0000000001f8eb10 winlogon.exe        528    448 0x0dcf3000 2005-06-25 16:47:31 UTC+0000
0x0000000001f9a670 spoolsv.exe        1224    580 0x1147b000 2005-06-25 16:47:39 UTC+0000
0x0000000001fa5aa0 svchost.exe         740    580 0x0e575000 2005-06-25 16:47:32 UTC+0000
0x0000000001fa8240 Smc.exe             876    580 0x0eb72000 2005-06-25 16:47:33 UTC+0000
0x0000000001fa8650 svchost.exe         800    580 0x0e8ea000 2005-06-25 16:47:33 UTC+0000
0x0000000001faba78 svchost.exe         840    580 0x0ea71000 2005-06-25 16:47:33 UTC+0000
0x0000000001faf280 jusched.exe         188   1812 0x1413d000 2005-06-25 16:47:49 UTC+0000
0x0000000001fdf020 smss.exe            448      4 0x0c55a000 2005-06-25 16:47:28 UTC+0000
0x0000000002000980 wmiprvse.exe       4080    740 0x10b87000 2005-06-25 16:57:53 UTC+0000
0x0000000002021a78 Rtvscan.exe        1304    580 0x14cc6000 2005-06-25 16:47:58 UTC+0000
0x00000000020238e0 snmp.exe           1424    580 0x14f3a000 2005-06-25 16:47:58 UTC+0000
0x0000000002025608 atiptaxx.exe       2040   1812 0x13d79000 2005-06-25 16:47:49 UTC+0000
0x000000000202bda0 explorer.exe       1812   1764 0x131eb000 2005-06-25 16:47:47 UTC+0000
0x0000000002059da0 DefWatch.exe        864    580 0x14aa7000 2005-06-25 16:47:55 UTC+0000
```

```
0x00000000004096da0 svchost.exe        1484    580 0x1515f000 2005-06-25 16:47:59 UTC+0000
0x000000000ee763b0 iexplore.exe        2392   1812 0x16f8f000 2005-06-25 16:51:02 UTC+0000
0x000000000f55d670 spoolsv.exe         1224    580 0x1147b000 2005-06-25 16:47:39 UTC+0000
0x000000000fe5f8e0 snmp.exe            1424    580 0x14f3a000 2005-06-25 16:47:58 UTC+0000
0x0000000012cd3020 smss.exe             448      4 0x0c55a000 2005-06-25 16:47:28 UTC+0000
0x0000000012d67a90 Fast.exe            1960   1812 0x13aaf000 2005-06-25 16:47:48 UTC+0000
0x00000000131f0da0 svchost.exe          984    580 0x10220000 2005-06-25 16:47:35 UTC+0000
0x0000000013a36a78 svchost.exe          840    580 0x0ea71000 2005-06-25 16:47:33 UTC+0000
0x0000000013a597e8 svchost.exe         1024    580 0x1043e000 2005-06-25 16:47:35 UTC+0000
0x0000000013f924e8 dd.exe              4012   2624 0x0eee8000 2005-06-25 16:58:46 UTC+0000
0x0000000016c7f9d0 PluckUpdater.ex     1916    944 0x1ba0e000 2005-06-25 16:51:40 UTC+0000   2005-06-25 16:53:4
000
0x00000000171033b0 iexplore.exe        2392   1812 0x16f8f000 2005-06-25 16:51:02 UTC+0000
0x0000000017fdb020 alg.exe             2868    580 0x18679000 2005-06-25 16:48:11 UTC+0000
0x00000000186fec10 firefox.exe         2160   1812 0x1d484000 2005-06-25 16:49:22 UTC+0000
0x00000000018899da0 svchost.exe         984    580 0x10220000 2005-06-25 16:47:35 UTC+0000
0x000000001a192a90 Fast.exe            1960   1812 0x13aaf000 2005-06-25 16:47:48 UTC+0000
```

5. What command was typed/running in a command prompt?

   Command used: volatility.exe -f E:\Memory Forenscis\xp-laptop-2005-06-25.img --profile WinXPSP2x86 cmdscan

   Cmdscan: used to display the command that were typed in command prompt

Select Volatility

```
C:\Users\student\Downloads\volatility_2.6_win64_standalone>volatility.exe -f "E:\Memory Forensics\xp-laptop-2005-06-2
5.img" --profile WinXPSP2x86 cmdscan
Volatility Foundation Volatility Framework 2.6
**************************************************
CommandProcess: csrss.exe Pid: 504
CommandHistory: 0x4e4d88 Application: cmd.exe Flags: Allocated, Reset
CommandCount: 7 LastAdded: 6 LastDisplayed: 6
FirstCommand: 0 CommandCountMax: 50
ProcessHandle: 0x4c8
Cmd #0 @ 0x4e2d28: d:
Cmd #1 @ 0x4e1f78: cd  dd
Cmd #2 @ 0x4e2cc8: dir
Cmd #3 @ 0x4e2e00: cd UnicodeRelease
Cmd #4 @ 0x4e2cb8: dir
Cmd #5 @ 0x4e1f90: dd
Cmd #6 @ 0x4e1ff8: dd if=\\.\PhysicalMemory of=c:\xp-laptop-2005-06-25.img conv=noerror
Cmd #7 @ 0x4e2df0: c
Cmd #8 @ 0x4e2e00: cd UnicodeRelease
Cmd #10 @ 0x4e2e40: N?N??
dd.exe
Cmd #11 @ 0x4e2e50: d.exe
Cmd #13 @ 0x4e2ee8: md.exe
**************************************************
CommandProcess: csrss.exe Pid: 504
CommandHistory: 0x11253b0 Application: dd.exe Flags: Allocated, Reset
CommandCount: 1 LastAdded: 0 LastDisplayed: 0
FirstCommand: 0 CommandCountMax: 50
ProcessHandle: 0x2a4
Cmd #0 @ 0x4e2df0: c

C:\Users\student\Downloads\volatility_2.6_win64_standalone>
```

6. What processes potentially were running malware?

   Command used: volatility.exe -f E:\Memory Forenscis\xp-laptop-2005-06-25.img --profile WinXPSP2x86 malfind

   Malfind: used to check for hidden processes and injected code, it doesn't give which process/ dll the code was injected to but the process that runs the injected code.

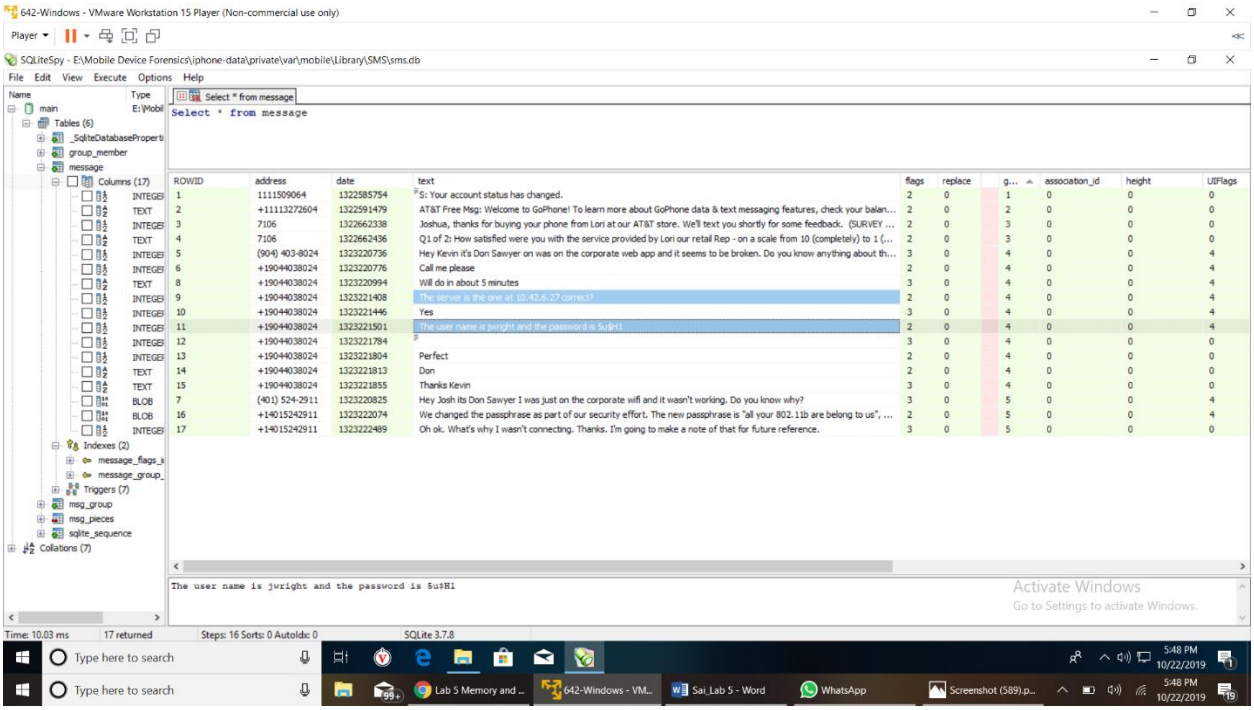
```
Process: csrss.exe Pid: 504 Address: 0x7f6f0000
Vad Tag: Vad  Protection: PAGE_EXECUTE_READWRITE
Flags: Protection: 6

0x7f6f0000  c8 00 00 00 2c 01 00 00 ff ee ff ee 08 70 00 00   ....,........p..
0x7f6f0010  08 00 00 00 00 fe 00 00 00 00 10 00 00 20 00 00   .................
0x7f6f0020  00 02 00 00 00 20 00 00 8d 01 00 00 ff ef fd 7f   .................
0x7f6f0030  03 00 08 06 00 00 00 00 00 00 00 00 00 00 00 00   .................

0x7f6f0000 c8000000         ENTER 0x0, 0x0
0x7f6f0004 2c01             SUB AL, 0x1
0x7f6f0006 0000             ADD [EAX], AL
Process: explorer.exe Pid: 1812 Address: 0x46e0000
Vad Tag: VadS Protection: PAGE_EXECUTE_READWRITE
Flags: CommitCharge: 1, MemCommit: 1, PrivateMemory: 1, Protection: 6

0x046e0000  00 00 00 00 59 e9 c6 29 e5 ff e8 f5 ff ff ff 00   ....Y..).......
0x046e0010  00 00 00 00 00 00 00 e8 e8 ff ff ff 0a 00 6e 04   ..............n.
0x046e0020  00 00 00 00 e8 db ff ff ff 17 00 6e 04 00 00 00   ...........n....
0x046e0030  00 e8 ce ff ff ff 24 00 6e 04 00 00 00 00 e8 c1   ......$.n.......

0x046e0000 0000             ADD [EAX], AL
0x046e0002 0000             ADD [EAX], AL
0x046e0004 59               POP ECX
Process: svchost.exe Pid: 840 Address: 0x1eca0000
Vad Tag: VadS Protection: PAGE_EXECUTE_READWRITE
Flags: CommitCharge: 4, MemCommit: 1, PrivateMemory: 1, Protection: 6

0x1eca0000  00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00   .................
0x1eca0010  00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00   .................
0x1eca0020  00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00   .................
0x1eca0030  00 00 00 00 25 00 25 00 01 00 00 00 00 00 00 00   ....%.%.........

0x1eca0000 0000             ADD [EAX], AL
0x1eca0002 0000             ADD [EAX], AL
0x1eca0004 0000             ADD [EAX], AL
0x1eca0006 0000             ADD [EAX], AL
```

2. Mobile Device Filesystem Forensics

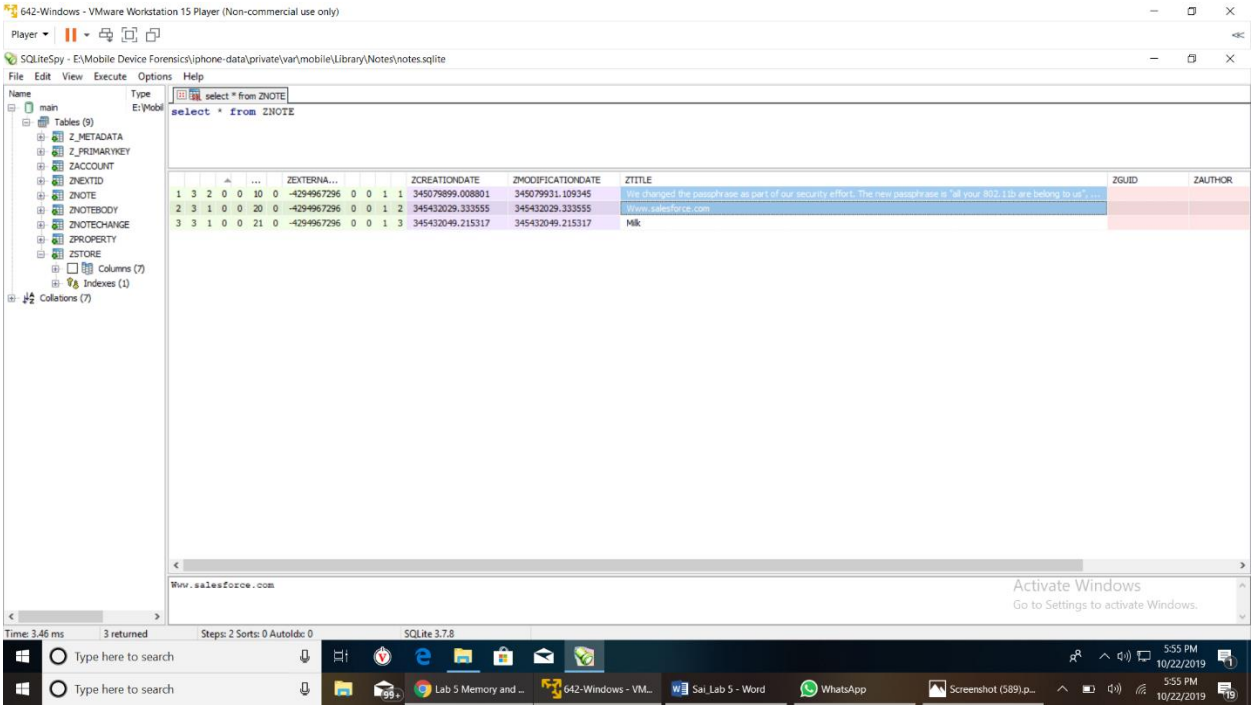
To use SQLlitespy one must have knowledge about SQL, which is a language used to query the database. For this lab we used very simple commands like ‘select * from message’

Select – this is used to specify the mode of operation
* from - is used to say ‘display everything’ (in a table)
message – this is the name of the table that we are trying to access

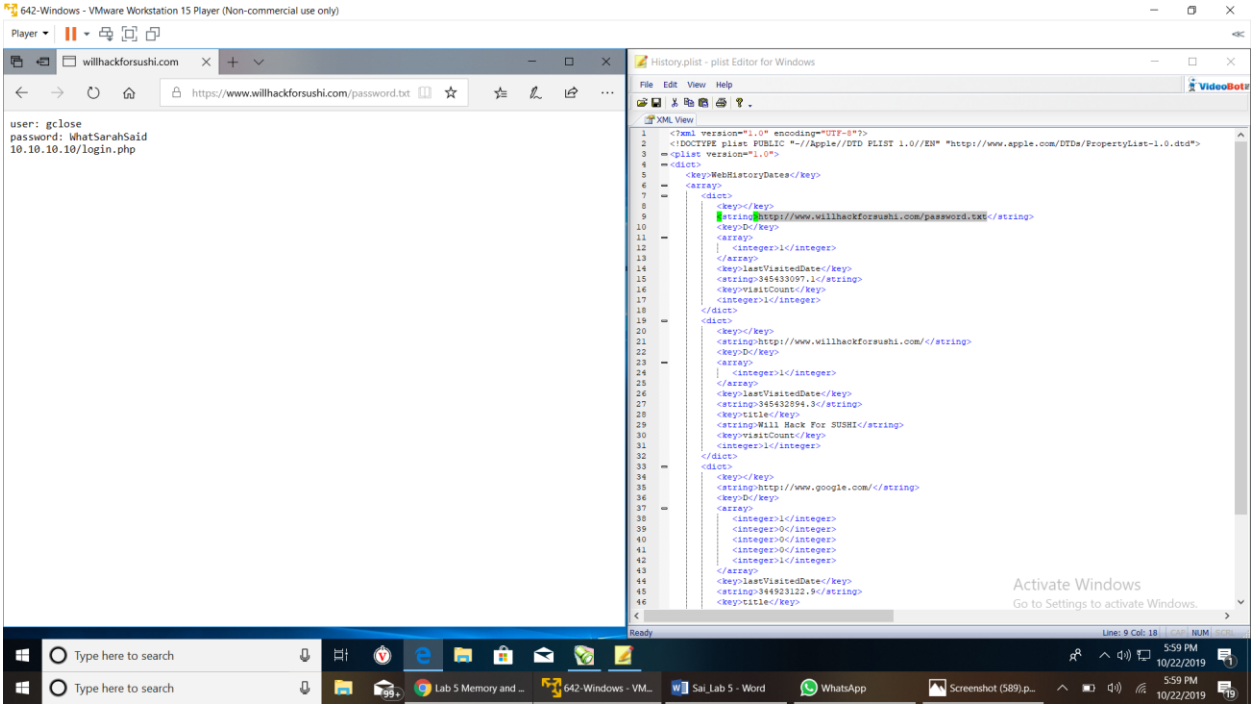
1. Access the SMS database and look for login credentials and wireless network credentials that were texted on the device



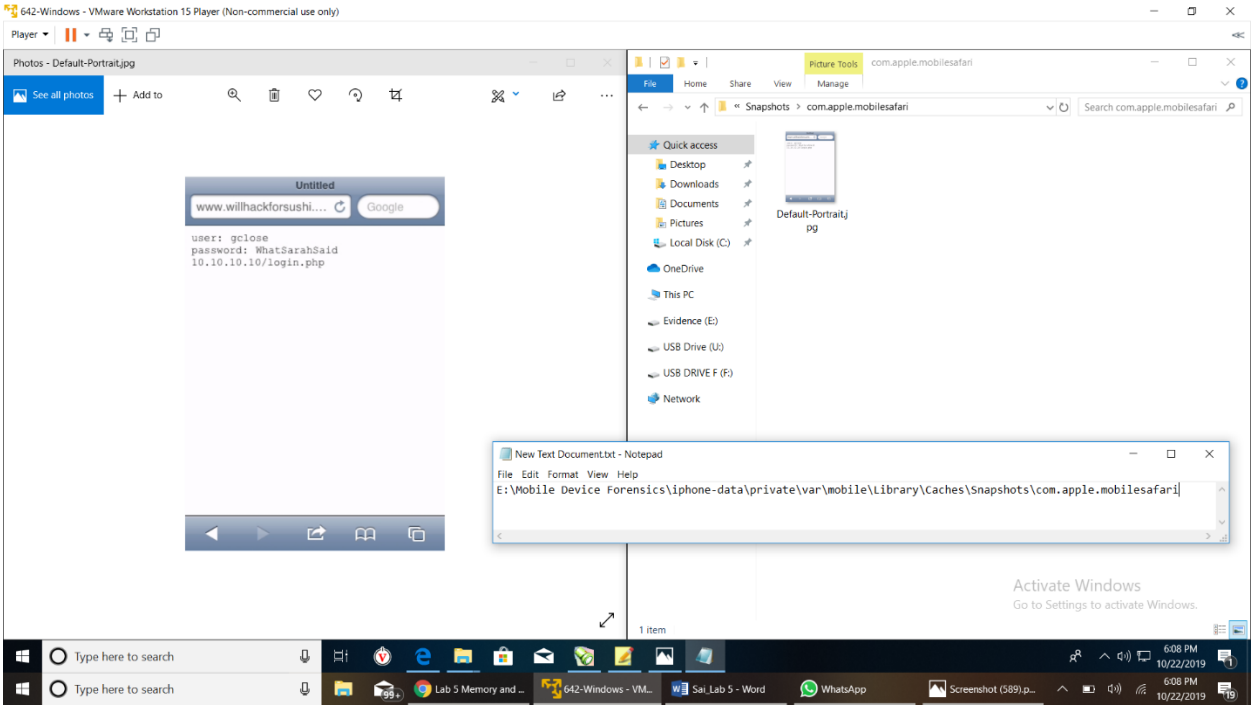
2. Access the notes database to look for information related to salesforce.com credentials.



3. Access the Safari History plist file and review it for a visit to a website that has a password document



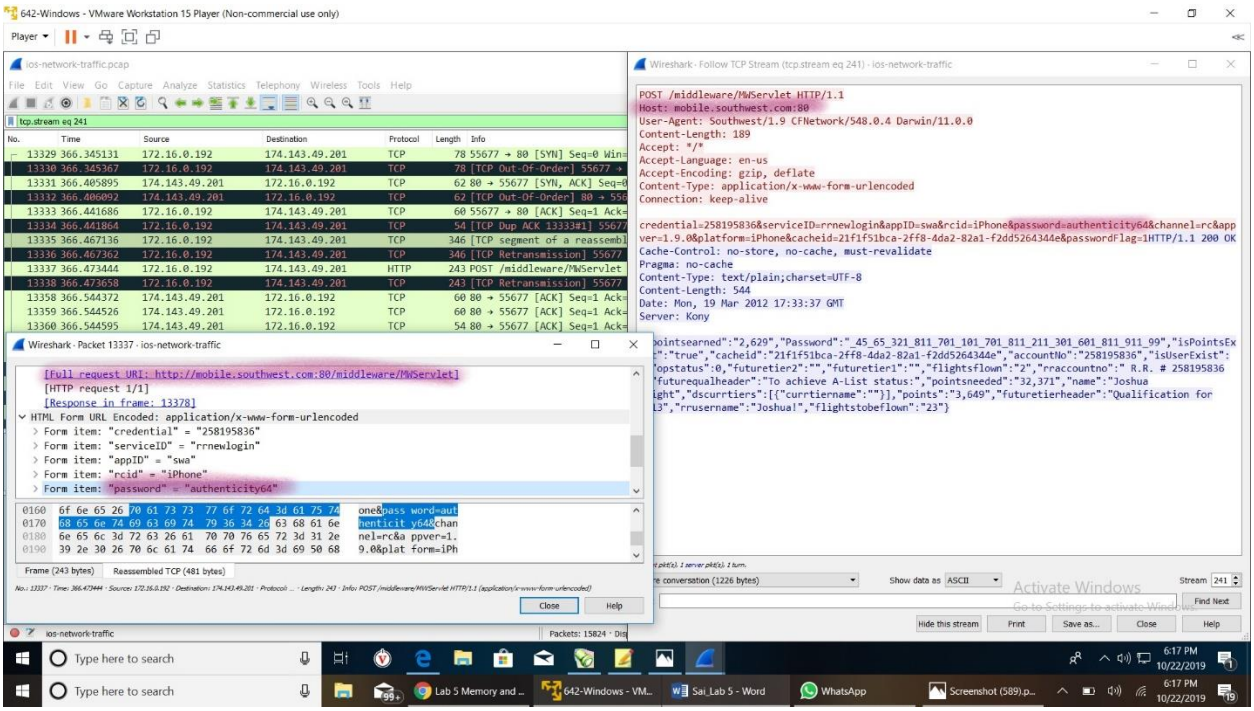
4. Access the Safari History snapshot to view the image of the last screen seen in the browser.



3. Mobile Device Network Forensics

1. What is the password used, and with what app on this iPhone?

   Application/ Website: southwest.com (on iPhone)
   Password: authenticity64



Conclusion

In this lab we could use tools like SQLlitespy, Plist Editor, Wireshark and Volatility which are all used to traverse through an image that was created, for volatility, and iPhone's image for the other tools. This lab gives us an introduction to using forensic tools and an idea of how mobile forensics is conducted.

References

[1] https://resources.infosecinstitute.com/finding-and-enumerating-processes-within-memory-part-1/#gref

[2] https://anupriti.blogspot.com/2015/10/extracting-usernamepasswords-from-ram.html

[3] https://medium.com/@zemelusa/first-steps-to-volatile-memory-analysis-dcbd4d2d56a1

[4] https://www.timeanddate.com/time/map/