VB Dropper and Shellcode for Hancitor Reveal New Techniques Behind Uptick

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The Hancitor downloader has been relatively quiet since a major campaign back in June 2016. But over the past week, while performing research using Palo Alto Networks AutoFocus, we noticed a large uptick in the delivery of the Hancitor malware family as they shifted away from H1N1 to distribute Pony and Vawtrak executables. In parallel, we received reports from other firms and security researchers seeing similar activity, which pushed us to look into this further.

Figure 1 AutoFocus view of new sessions of Hancitor since July 2016

The delivery method for these documents remained consistent to other common malicious e-mail campaigns. Lures contained subjects related to recent invoices, or other matters requiring the victim's attention, such as an overdue bill. These lures were expected, until we started digging into the actual documents attached and saw an interesting method within the Visual Basic (VB) macros in the attached documents used for dropping the malware.

This blog will review in detail the dropping technique, which isn't technically new, but this was the first time we've seen it used in this way. The end goal is to identify where the binary was embedded, but we'll cover the macro and the embedded shellcode throughout this post.

The Word Document

For this section, we'll be looking at the file with a SHA256 hash of '03aef51be133425a0e5978ab2529890854ecf1b98a7cf8289c142a62de7acd1a', which is a typical MS Office OLE2 Word Document with your standard ploy to 'Enable Content' and run the malicious macro.

Figure 2 The ploy used by the malicious document

Opening the Visual Basic editor up, we can see two forms and a module for this particular sample.

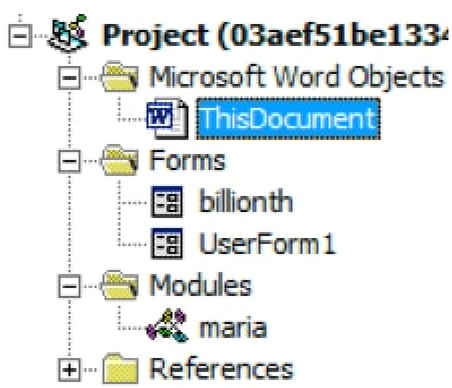


Figure 3 VBProject components

The Malicious Macro

Visual Basic can directly execute Microsoft Windows API calls, which allows it perform a number of interesting functions -- exactly what this VB code is doing.

```
#If Win64 Then
Private Declare PtrSafe Function maison Lib "kernel32" Alias "VirtualAlloc" (ByVal lpaddr As LongPtr, ByVal dwSiz
Private Declare PtrSafe Sub talapoin Lib "ntdll" Alias "RtlMoveMemory" (pDst As Any, pSrc As Any, ByVal ByteLen A
Private Declare PtrSafe Function malay Lib "kernel32" Alias "CreateEventA" (lpEventAttributes As Any,bManualReset
Private Declare PtrSafe Function hairbrush Lib "user32" Alias "CallWindowProcA" (lpPrevWndFunc As LongPtr, hWnd A
Private Declare PtrSafe Function viviparous Lib "user32" Alias "EndDialog" (ByVal hDlg As LongPtr,nResult As Long
Private Declare PtrSafe Function functus Lib "kernel32" Alias "GetPriorityClass" (hProcess As LongPtr) As LongPtr
Private Declare PtrSafe Function headwaters Lib "user32" Alias "GetDlgItem" (ByVal hDlg As LongPtr, nIDDlgItem As

#Else
Private Declare Function maison Lib "kernel32" Alias "VirtualAlloc" (ByVal lpaddr As Long, ByVal dwSize As Long,
Private Declare Sub talapoin Lib "ntdll" Alias "RtlMoveMemory" (pDst As Any, pSrc As Any, ByVal ByteLen As Long)
Private Declare Function twentythird Lib "user32" Alias "EndDialog" (ByVal hDlg As Long, nResult As Long) As Long
Private Declare Function chopin Lib "kernel32" Alias "CreateEventA" (lpEventAttributes As Any, bManualReset As Lo
Private Declare Function tost Lib "user32" Alias "GetDlgItem" (ByVal hDlg As Long, nIDDlgItem As Long) As Long
Private Declare Function hairbrush Lib "user32" Alias "CallWindowProcA" (lpPrevWndFunc As Long, hWnd As Any, Msg
Private Declare Function unselected Lib "kernel32" Alias "GetPriorityClass" (hProcess As Long) As Long
```

Figure 4 Microsoft Windows API calls within VB code

As we can see, the macro includes logic to determine the architecture of the system it's running on and has the ability to execute correctly on either 32-bit or 64-bit platforms. The primary calls of interest for us will be VirtualAlloc(), RtlMoveMemory(), and CallWindowProcA().

When we originally started looking at this sample, we were mainly interested in where the payload was being stored, so we began debugging the macro to understand how it functions. The payload in question is base64-encoded and embedded within a form in the VBProject as a value of the 'Text' field on the 'choline' TextBox.

As a side note, what is really interesting is that the authors went through the trouble to actually write their own base64 decoder purely in VB. We'll leave that as an exercise for the reader to dig into that but it's a good overview of how base-N encoding works; the entire 'maria' module within this macro is the base64 decoder.

The macro base64 decodes the payload into a local byte-array and then we come to our first API call, VirtualAlloc().

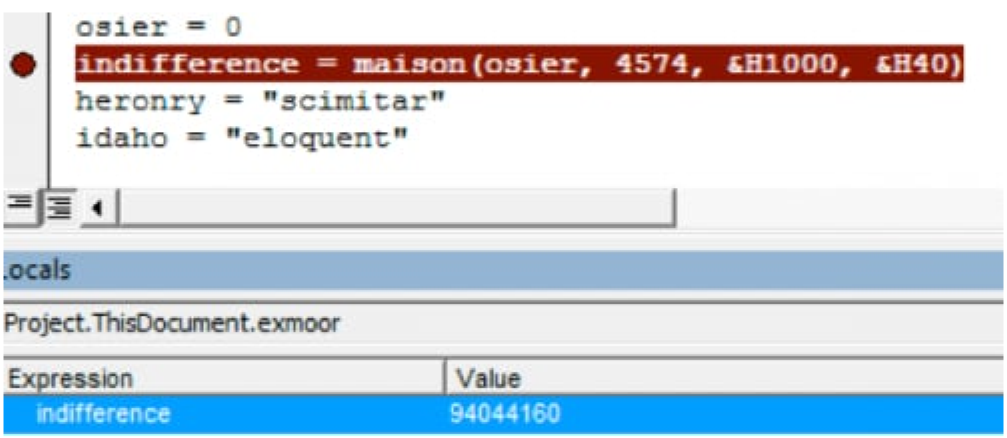
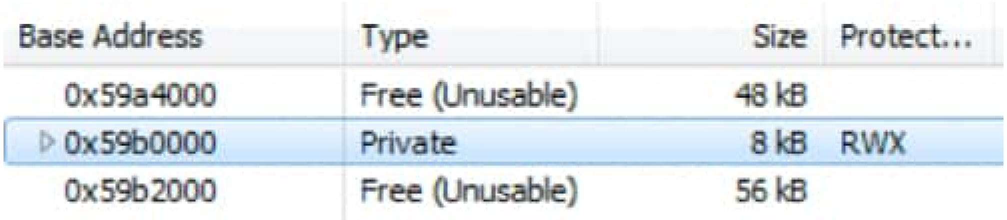


Figure 5 Memory page being allocated

The call commits specific pages of memory with read, write, and executable (RWX) permissions at 0x59B0000.



Base Address	Type	Size	Protect...
0x59a4000	Free (Unusable)	48 kB	
0x59b0000	Private	8 kB	RWX
0x59b2000	Free (Unusable)	56 kB	

Figure 6 New memory page with RWX permissions

Afterwards, the VB macro continues to setup the next call to RtlMoveMemory and then calls it with the location of the memory from the previous call and our base64 decoded byte array.

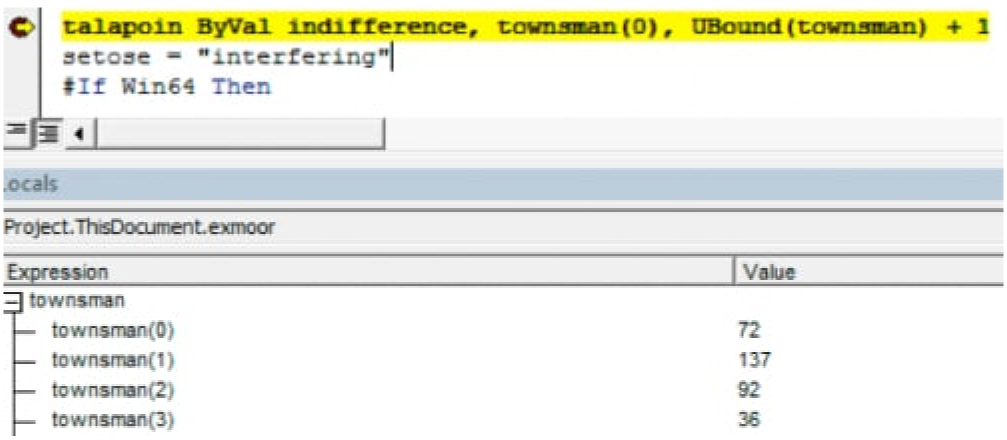


Figure 7 Base64-decoded byte array

We can quickly validate by dumping that region of memory in our WINWORD.EXE process and comparing transferred bytes.

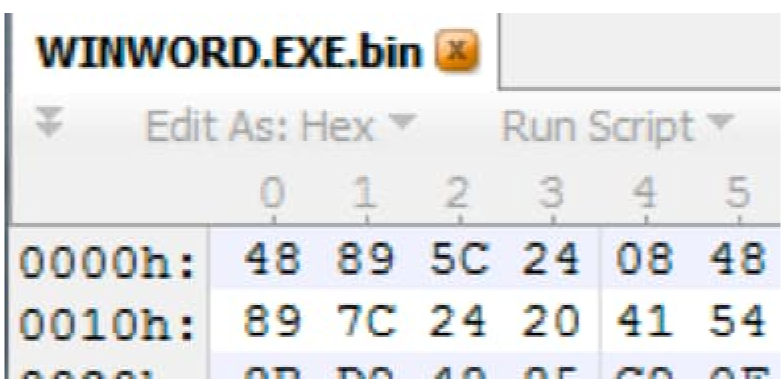


Figure 8 Confirming bytes match from dumped memory

Now that our code has been copied to in executable memory, the macro sets up the last API call for CallWindowProcA(). The first value supplied to this call is our memory offset +2214, which is a function pointer within this code, and the second is a string of the path to our file for a handle. These actions redirect code execution to shellcode.

Figure 9 Passing execution to the shellcode

The Shellcode

If we attach to WINWORD.EXE and break on the offset of our memory location +2214 (0x8A6), the entry point of the shellcode, we can validate program execution shifts to this code path.

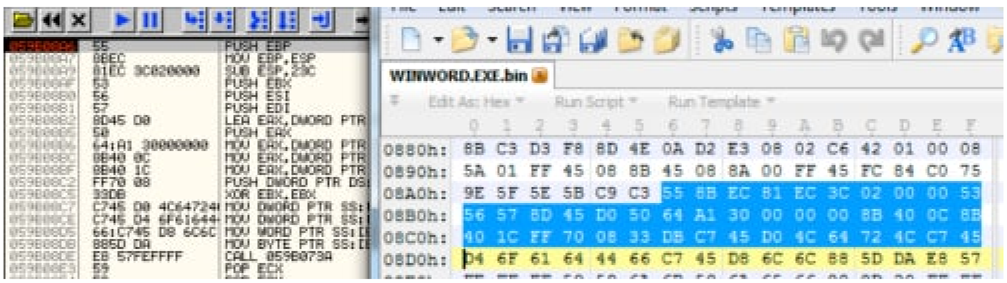


Figure 10 Validating shellcode is executing

From here, the shellcode gets the address for LdrLoadDLL() function, which is similar to LoadLibraryEx(), by enumerating the Process Environment Block (PEB) and then begins to hunt for the functions it will use within kernel32.dll.

The values for the functions it's looking for, along with other values, are embedded into the shellcode and built on the stack for later usage.

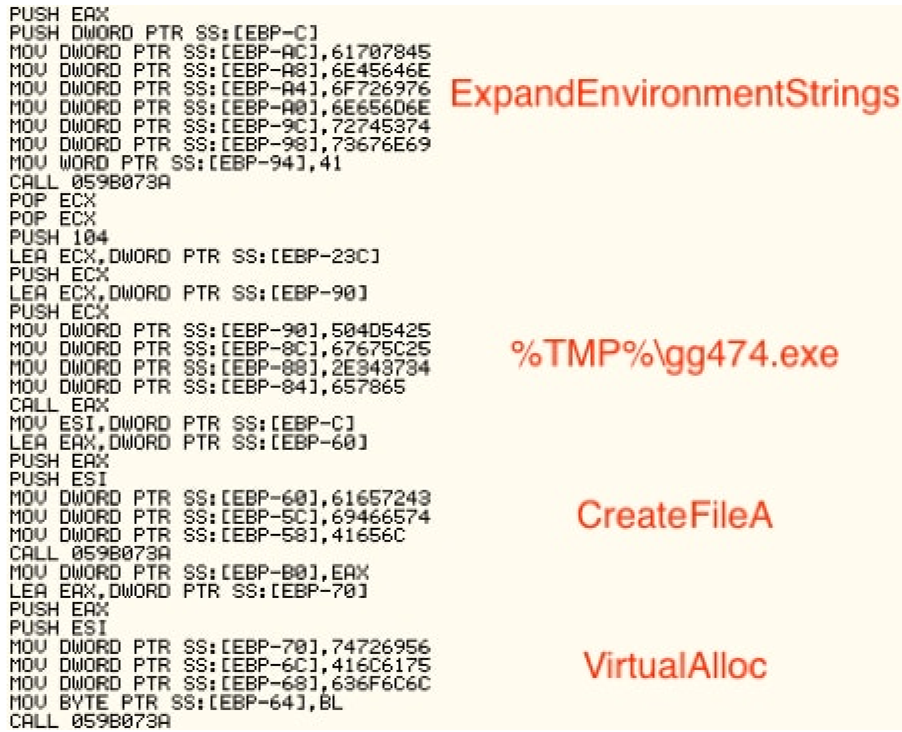


Figure 11 Embedded data in shellcode

Following these sets of encoded names, we can see the shellcode is interested in the following syscalls: CloseHandle(), ReadFile(), GetFileSize(), VirtualFree(), VirtualAlloc(), and CreateFileA(). For each API call, it looks up the address of the function and stores it on the stack.

Next, the shellcode calls CreateFileA() on the Word document and receives a handle back, which it passes to GetFileSize() for the file size, that is then subsequently passed to VirtualAlloc() to create a section of memory for the file contents (0x2270000). Finally, it reads in the file to that memory location and closes the handle.

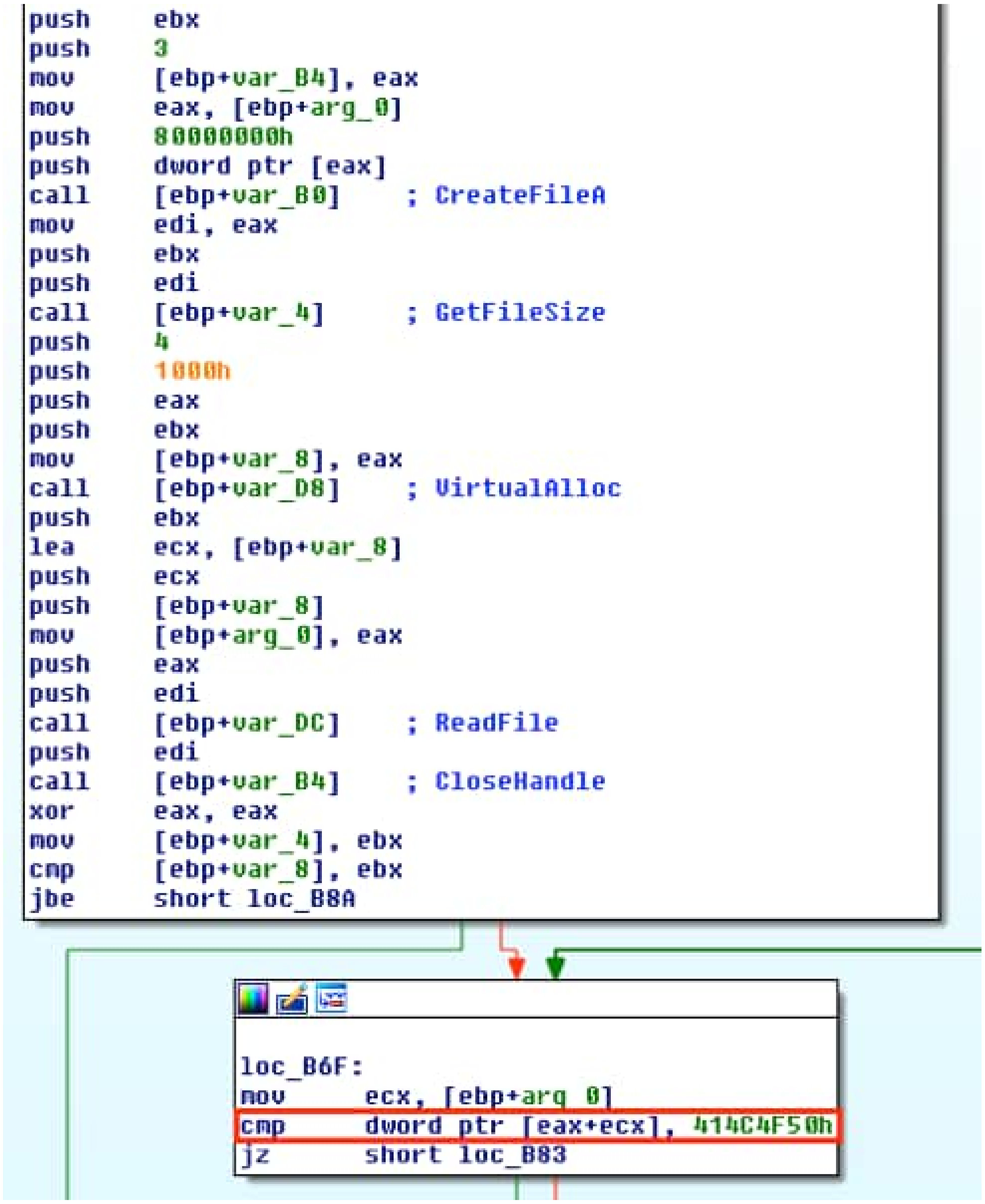


Figure 12 Egg hunting by the shellcode

Once it has the copy loaded into memory, it begins a process of hunting through memory for the magic bytes 0x504F4C41, which we can see is located at 0x022836F3 in our new memory page.

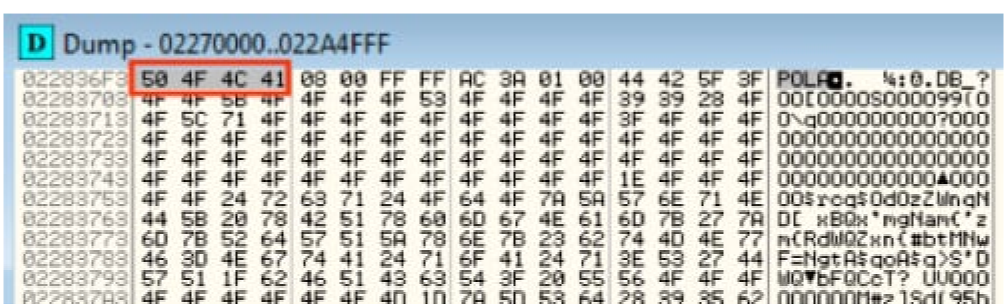


Figure 13 Egg located

Now that we've found what's likely to be our binary, the last step is to just decode it. Looking at the shellcode, we can see that it will add 0x3 to each byte starting at 0x22836FF, in our example, and then XOR it by 0x13, as shown below.

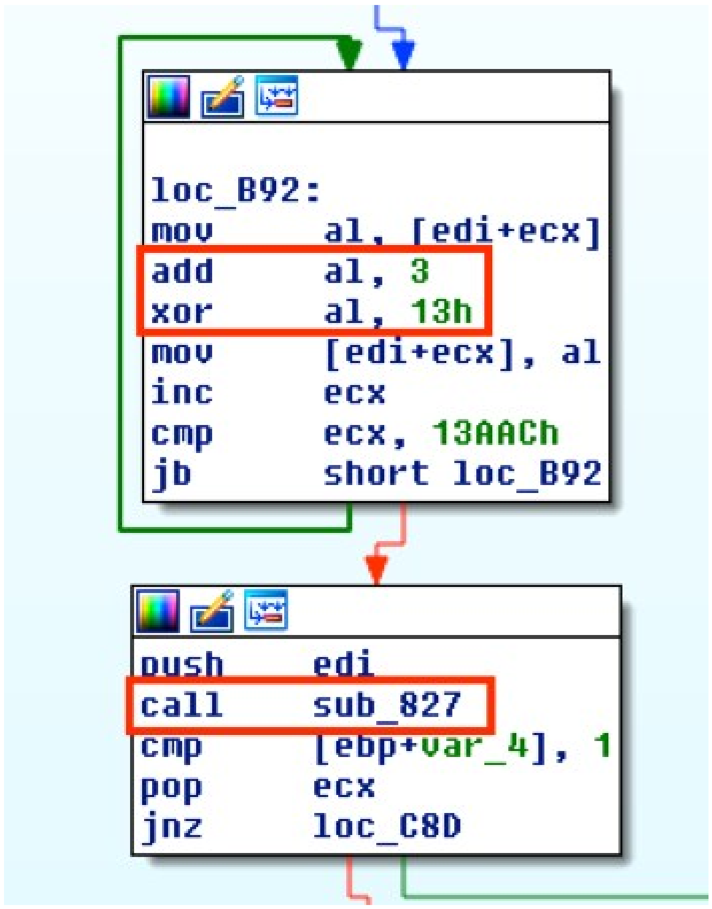


Figure 14 XOR decrypting

Once the counter reaches 0x13AAC (80556), it begins a series of sub-routines to manipulate each byte and decrypt the binary. If we set a breakpoint after the decryption routine and check our memory location, we can see that the binary is decoded and can now be dumped for further analysis. The MZ and PE headers can be seen in the following dumped memory.

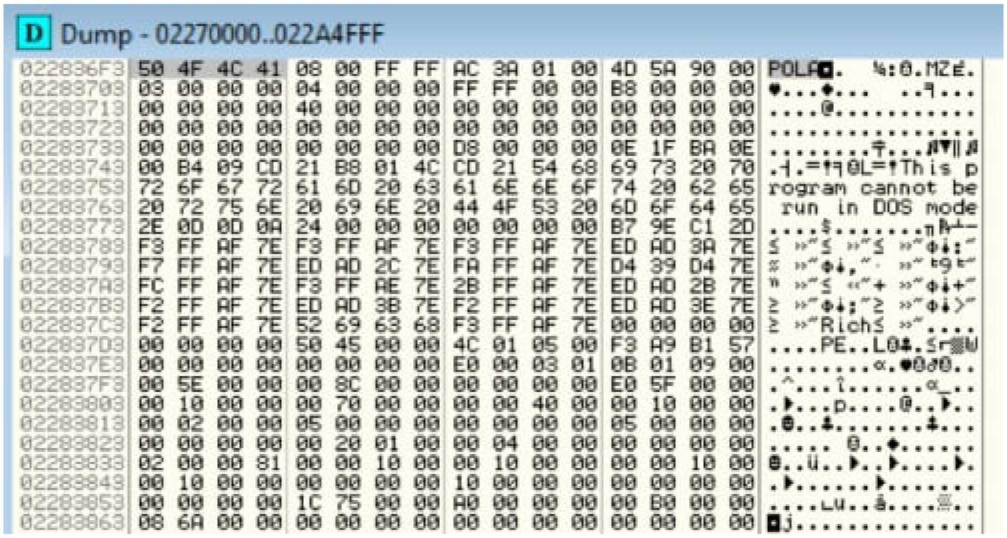


Figure 15 Decoded binary

For this particular campaign run with this dropper, it places the binary in the %TMP% directory before launching it, which then ends up writing itself to '%SYSTEMROOT%/system32/WinHost.exe'.

At this point, the Hancitor downloader has been fully loaded on the victim's machine, where it will proceed to perform additional malicious activities.

Conclusion

Macro-based techniques are quite common, but the technique being used here with the macro dropper is an interesting variation. From the encoded shellcode within the macro and using native API calls within VB code to pass execution to carving out and decrypting the embedded malware from the Word document, it's a new use of Hancitor that we'll be following closely. .

Palo Alto Networks customers are protected from the dropper detailed throughout this blog and its contained Hancitor payload. You can continue to track this threat through the AutoFocus Hancitor tag. Additionally, all Hancitor downloader samples are identified as malicious in WildFire. Domains used by Hancitor are also categorized as malicious.

Acknowledgements

For more analysis of the Hancitor payload, please see this write-up by Minerva Labs.

Indicators of Compromise

Below are some of the most common observed e-mail subjects and file names seen in the latest campaign this week from over 380,000 sessions. Patterns substituted with regex or representation.

Email Subjects

<domain> invoice for <month>

levi.com invoice for august

<domain> bill
<domain> deal
<domain> receipt
<domain> contract
<domain> invoice

metlife.com bill
metlife.com deal
metlife.com receipt
metlife.com contract
metlife.com invoice

File Names

artifact[0-9]{9}.doc
bcbsde.com_contract.doc
contract_[0-9]{6}.doc
generic.doc
price_list.doc_[0-9]{6}.doc
report_[0-9]{6}.doc

In addition, we observed these C2 calls out during analysis, which can be detected at your perimeter by the use of '/(sl|zaopy)/gate.php'.

hxxp://betsuriin[.]com/sl/gate.php
hxxp://callereb[.]com/zapoy/gate.php
hxxp://evengsosandpa[.]ru/ls/gate.php
hxxp://felingdoar[.]ru/sl/gate.php
hxxp://gmailsign[.]info/plasma/gate.php
hxxp://hecksafaor[.]com/zapoy/gate.php
hxxp://heheckbitont[.]ru/sl/gate.php
hxxp://hianingherla[.]com/sl/gate.php
hxxp://hihimbety[.]ru/sl/gate.php
hxxp://meketusebet[.]ru/sl/gate.php
hxxp://mianingrabted[.]ru/zapoy/gate.php
hxxp://moatleftbet[.]com/sl/gate.php
hxxp://mopejusron[.]ru/sl/gate.php
hxxp://muchcocaugh[.]com/sl/gate.php

hxxp://ningtoparec[.]ru/sl/gate.php
hxxp://nodosandar[.]com/ls/gate.php
hxxp://nodosandar[.]com/zapoy/gate.php
hxxp://ritbeugin[.]ru/ls/gate.php
hxxp://rutithegde[.]ru/sl/gate.php
hxxp://surofonot[.]ru/sl/gate.php
hxxp://uldintoldhin[.]com/sl/gate.php
hxxp://unjustotor[.]com/sl/gate.php
hxxp://wassuseidund[.]ru/sl/gate.php

The below Yara rule can be used to detect this particular dropper and technique described throughout this blog.

```
rule hancitor_dropper : vb_win32api
{
  meta:
    author = "Jeff White - jwhite@paloaltonetworks @noottrak"
    date   = "18AUG2016"
    hash1  =
"03aef51be133425a0e5978ab2529890854ecf1b98a7cf8289c142a62de7acd1a"
    hash2  =
"4b3912077ef47515b2b74bc1f39de44ddd683a3a79f45c93777e49245f0e9848"
    hash3  =
"a78972ac6dee8c7292ae06783cfa1f918bacfe956595d30a0a8d99858ce94b5a"

  strings:
    $api_01 = { 00 56 69 72 74 75 61 6C 41 6C 6C 6F 63 00 }  // VirtualAlloc
    $api_02 = { 00 52 74 6C 4D 6F 76 65 4D 65 6D 6F 72 79 00 }  // RtlMoveMemory
    $api_04 = { 00 43 61 6C 6C 57 69 6E 64 6F 77 50 72 6F 63 41 00 }  //
CallWindowProcAi
    $magic  = { 50 4F 4C 41 }  // POLA

  condition:
    uint32be(0) == 0xD0CF11E0 and all of ($api_*) and $magic
}
```

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