Practical Malware Analysis & Triage

Malware Analysis Report

Unknown_RE1012018.zip

Feb 2024 | Amna Jasser | v1.0

Table of Contents

Executive Summary

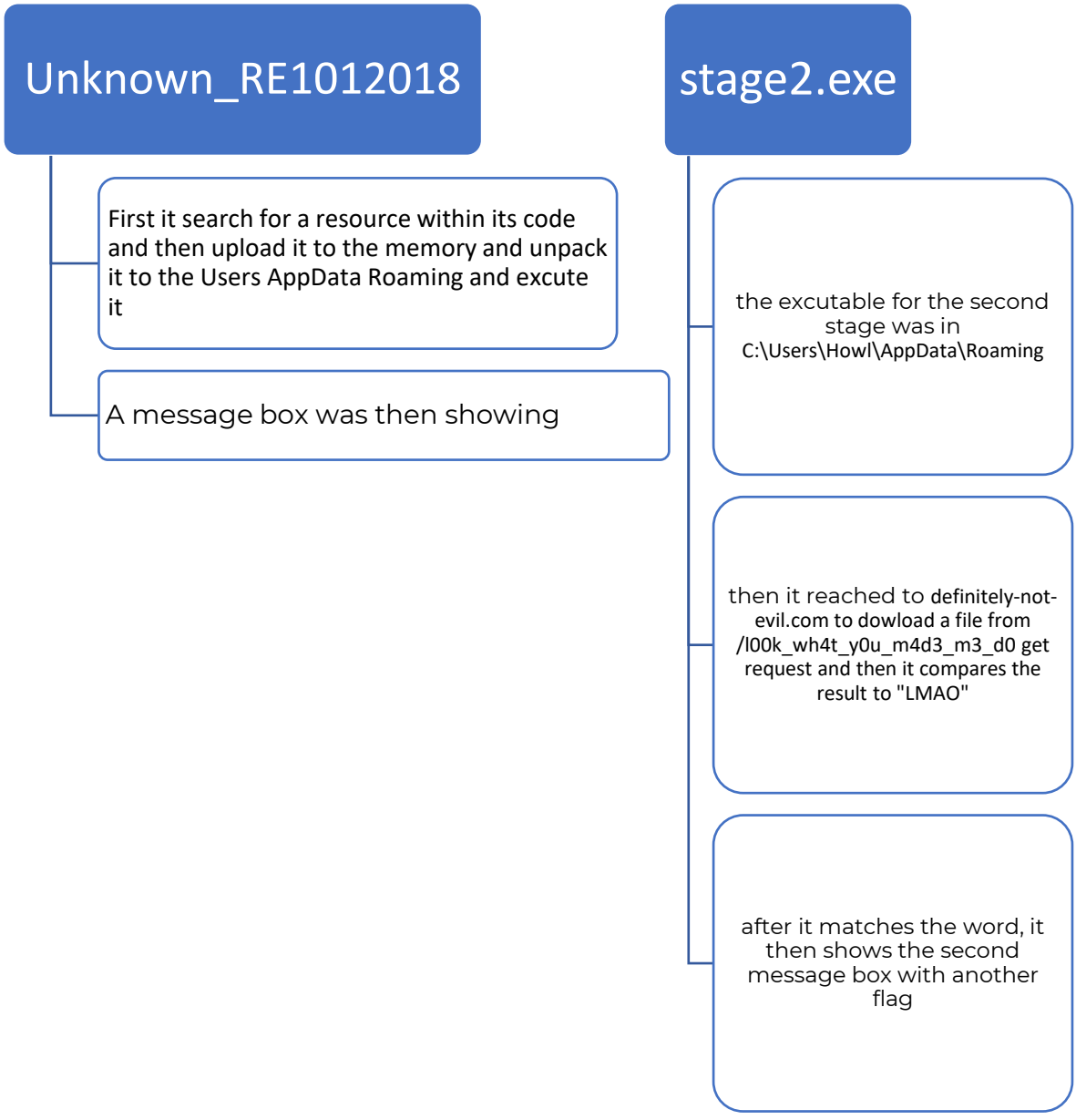
SHA256 hash	EC905CB2CB8E9F74790ADDE2C138807F3A6CDBECD5735FA5035B547280D7DB79

The malware `unknown_re1012018` is a PE (Portable Executable) file that intricately conceals another PE within its code. This embedded PE, identified as "stage2.exe," is systematically extracted, uploaded into the system's memory, and unpacked in the Users' AppData Roaming directory. Following this process, the unpacked resource is executed, revealing a multifaceted approach to its malicious operations. The subsequent steps involve communication with the server definitely-not-evil.com, where a file is downloaded using a GET request from the specified path "/l00k_wh4t_y0u_m4d3_m3_d0." The content of this downloaded file is then compared to the string "LMAO." Upon a successful match, a second message box is displayed, signifying the completion of the second stage and potentially providing a flag or pertinent information about the malware's activities. This layered execution strategy demonstrates the malware's sophistication in evading detection and executing malicious actions.

YARA signature rules are attached in Appendix A. Malware sample and hashes have been submitted to VirusTotal for further examination.

High-Level Technical Summary

Unknown_RE1012018.exe is a PE file that unpacked to another PE file which is the next stage.



Step 1: Search for a resource “stage2.exe” within the code.

Step 2: Upload the resource to the memory.

Step 3: Unpack the resource to the Users' AppData Roaming directory.

Step 4: Execute the unpacked resource.

Step 5: A message box appears.

Step 6: stage2.exe executes and connect to definitely-not-evil.com.

Step 7: Download a file from /l00k_wh4t_y0u_m4d3_m3_d0 using a GET request.

Step 8: Compare the result of the download to the string "LMAO."

Step 9: After matching the word, display a second message box.

Malware Composition

Unknown_RE1012018.exe consists of the following components:

File Name	SHA256 Hash
Unknown_RE1012018	92730427321A1C4CCFC0D0580834DAEF98121EFA9BB8963DA332BFD6CF1FDA8A
stage2.exe	3EDA6E2DAE6FA86245A688EB24E0A29BF206242560C71C9D7726E5DE02D4538A

Unknown_RE1012018

The initial PE file that is packed with another PE stage2.exe, in the code it holds a flag and a message box will show.

Stage2.exe

This file is unpacked from the first file, then it connects to definitely-not-evil.com and request from it / l00k_wh4t_y0u_m4d3_m3_d0 and compare it to “lmao” and if it’s the same it will show another message box with a flag.

Basic Static Analysis

{Screenshots and description about basic static artifacts and methods}

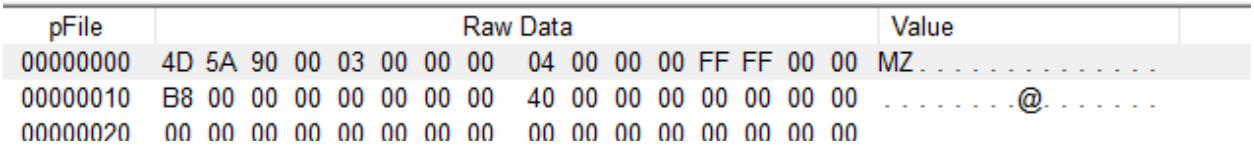
Looking at the **strings** output we see:

!This program cannot be run in DOS mode. (twice)
hflagh{i_shtay_hout_htoo_hlateh_goth_nothhingh_in_hmy_bhrainj}
00000A70 Im totally malware 00000A84 totally not malware
Dimmaletyoufinishbut
definitely-not-evil.com
l00k_wh4t_y0u_m4d3_m3_d0
stage2.exe
00000E07 Dimmaletyoufinishbut
00001F10 l00k_wh4t_y0u_m4d3_m3_d0

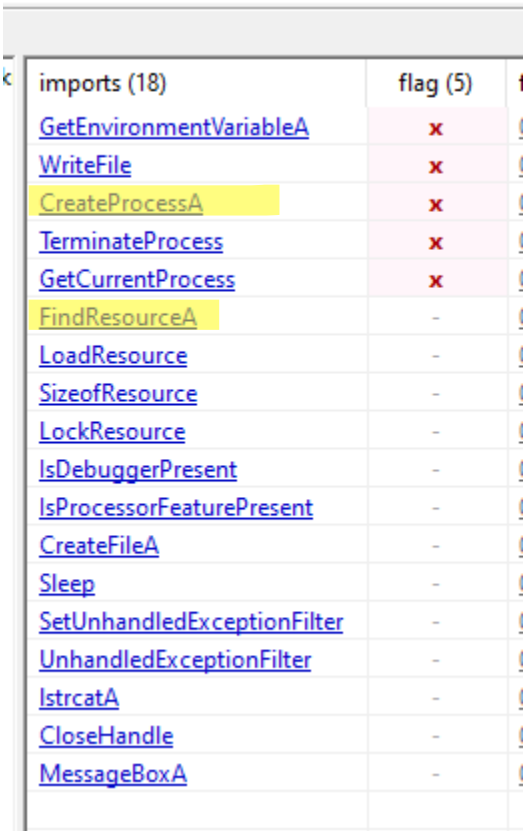
Since this !This program cannot be run in DOS mode. Was appeared twice then there is an indication that there is another PE file within the PE file.

PEStudio:

Notice the first 2 bytes are **MZ** meaning it's a PE Binary



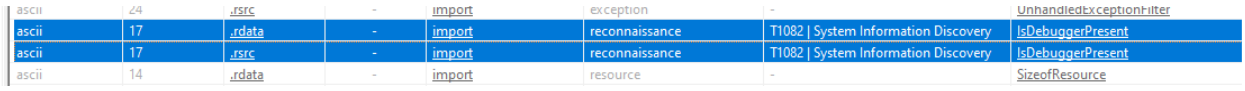
file-type: executable



imports (18)	flag (5)
GetEnvironmentVariableA	x
WriteFile	x
CreateProcessA	x
TerminateProcess	x
GetCurrentProcess	x
FindResourceA	-
LoadResource	-
SizeofResource	-
LockResource	-
IsDebuggerPresent	-
IsProcessorFeaturePresent	-
CreateFileA	-
Sleep	-
SetUnhandledExceptionFilter	-
UnhandledExceptionFilter	-
lstrcatA	-
CloseHandle	-
MessageBoxA	-

- Notice that is using **FindResourceA** and **CreateProcessA**. This means the executable might be extracting something out of the resource section and run it as a new process.

It is also checking if it is running in a debugger:



ascii	24	.rsrc	-	import	exception	-	UnhandledExceptionFilter
ascii	17	.rdata	-	import	reconnaissance	T1082 | System Information Discovery	IsDebuggerPresent
ascii	17	.rsrc	-	import	reconnaissance	T1082 | System Information Discovery	IsDebuggerPresent
ascii	14	.rdata	-	import	resource	-	SizeofResource

And this is the import table:

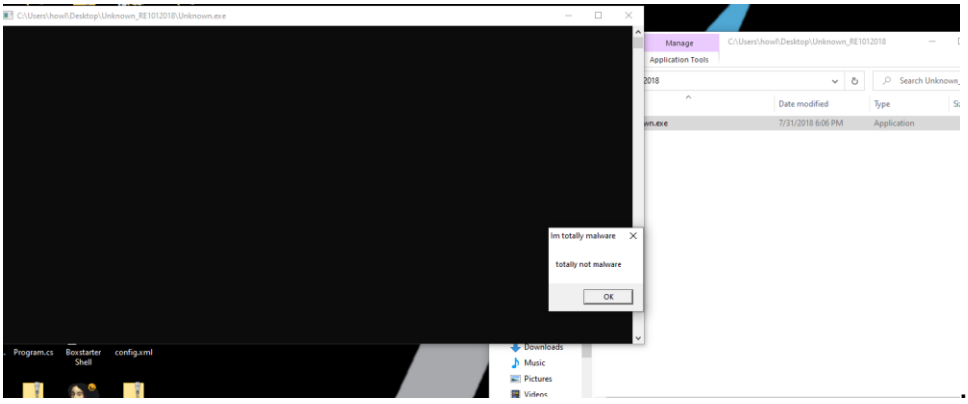
pFile	Data	Description	Value
00000A00	00002124	Hint/Name RVA	0088 CreateFileA
00000A04	00002132	Hint/Name RVA	014B FindResourceA
00000A08	00002142	Hint/Name RVA	0341 LoadResource
00000A0C	00002152	Hint/Name RVA	0525 WriteFile
00000A10	0000215E	Hint/Name RVA	04B2 Sleep
00000A14	00002166	Hint/Name RVA	04B1 SizeofResource
00000A18	00002178	Hint/Name RVA	00A4 CreateProcessA
00000A1C	0000218A	Hint/Name RVA	053E lstrcatA
00000A20	00002196	Hint/Name RVA	01DB GetEnvironmentVariableA
00000A24	000021B0	Hint/Name RVA	0354 LockResource
00000A28	000021C0	Hint/Name RVA	0052 CloseHandle
00000A2C	00002258	Hint/Name RVA	0300 IsDebuggerPresent
00000A30	0000223A	Hint/Name RVA	04A5 SetUnhandledExceptionFilter
00000A34	000021F6	Hint/Name RVA	04C0 TerminateProcess
00000A38	0000220A	Hint/Name RVA	01C0 GetCurrentProcess
00000A3C	0000221E	Hint/Name RVA	04D3 UnhandledExceptionFilter
00000A40	0000226C	Hint/Name RVA	0304 IsProcessorFeaturePresent
00000A44	00000000	End of Imports	KERNEL32.dll
00000A48	000021DC	Hint/Name RVA	020E MessageBoxA
00000A4C	00000000	End of Imports	USER32.dll

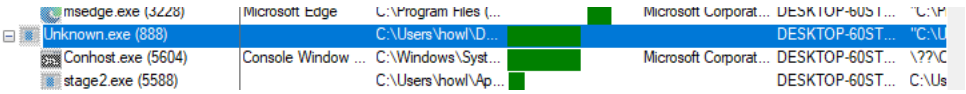
Basic Dynamic Analysis

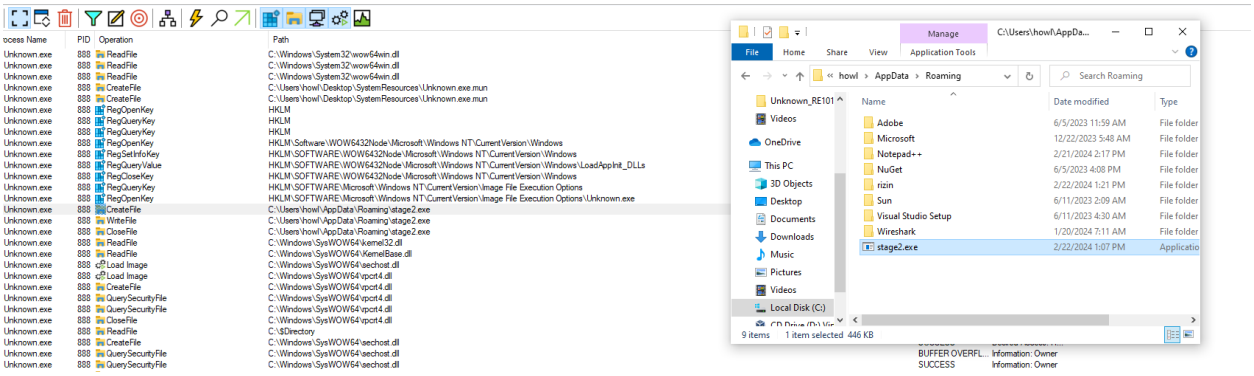
{Screenshots and description about basic dynamic artifacts and methods}

When running the file without internet connection:

1- It shows a black command line for a second and a message box with “totally not malware”:







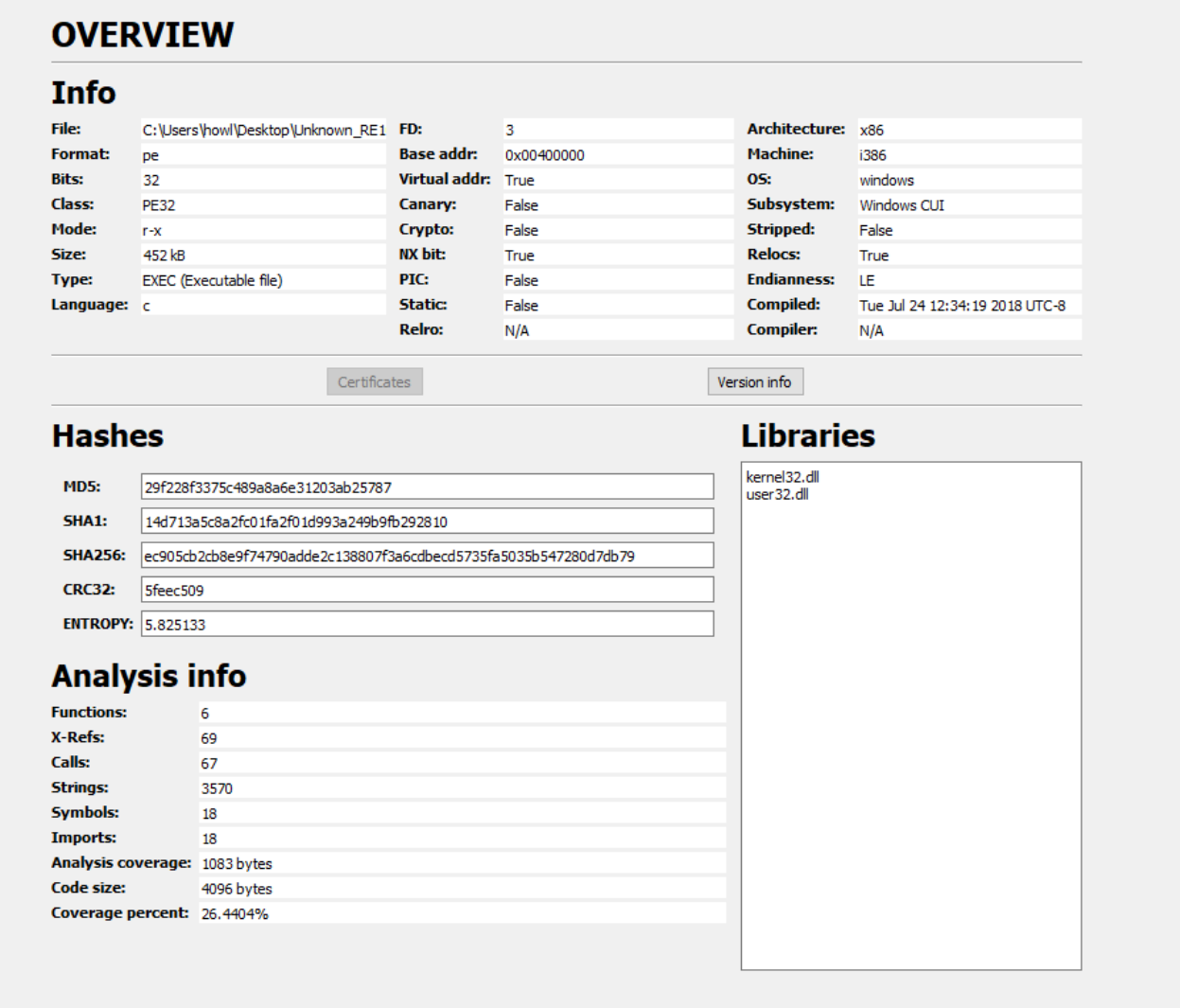
When there is an internet connection:

Even with internet it is the same result, So wee need to check with debugger.

Advanced Static Analysis

{Screenshots and description about findings during advanced static analysis} Could not

Looking at cutter info about this PE:



OVERVIEW

Info

File:	C:\Users\howl\Desktop\Unknown_RE1	**FD:**	3	**Architecture:**	x86
Format:	pe	**Base addr:**	0x00400000	**Machine:**	i386
Bits:	32	**Virtual addr:**	True	**OS:**	windows
Class:	PE32	**Canary:**	False	**Subsystem:**	Windows CUI
Mode:	r-x	**Crypto:**	False	**Stripped:**	False
Size:	452 kB	**NX bit:**	True	**Relocs:**	True
Type:	EXEC (Executable file)	**PIC:**	False	**Endianness:**	LE
Language:	c	**Static:**	False	**Compiled:**	Tue Jul 24 12:34:19 2018 UTC-8
		Relro:	N/A	**Compiler:**	N/A

Certificates | Version info

Hashes

MD5:	29f228f3375c489a8a6e31203ab25787
SHA1:	14d713a5c8a2fc01fa2f01d993a249b9fb292810
SHA256:	ec905cb2cb8e9f74790adde2c138807f3a6cdbecd5735fa5035b547280d7db79
CRC32:	5feec509
ENTROPY:	5.825133

Libraries

kernel32.dll
user32.dll

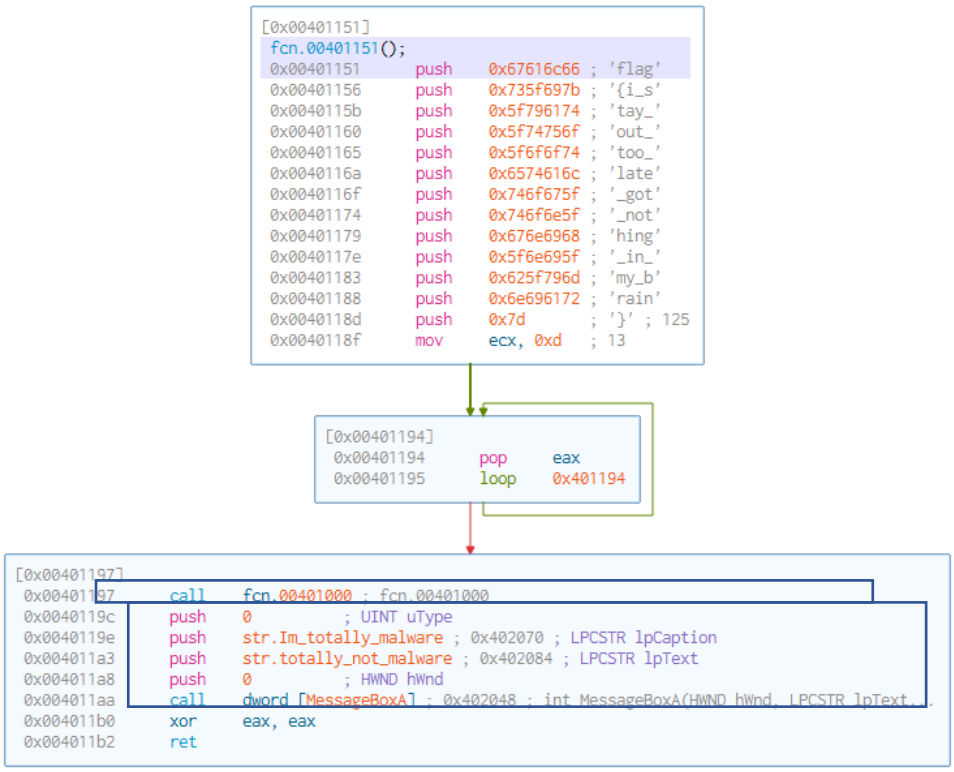
Analysis info

Functions:	6
X-Refs:	69
Calls:	67
Strings:	3570
Symbols:	18
Imports:	18
Analysis coverage:	1083 bytes
Code size:	4096 bytes
Coverage percent:	26.4404%

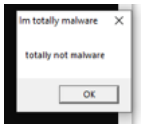
We now know it is built with C and x86 instruction.

Looking at the main function of Unknown_RE1012018.exe:

Analysing Function **0x00401151:**



1- In the first we see the flagh{i_stay_out_too_late_got_nothing_in_my_brain}
2- Then it will loop 13 times as loop decrement ecx value.
3- Then it will call function **0x00401000**
4- Call MessageBoxA function:

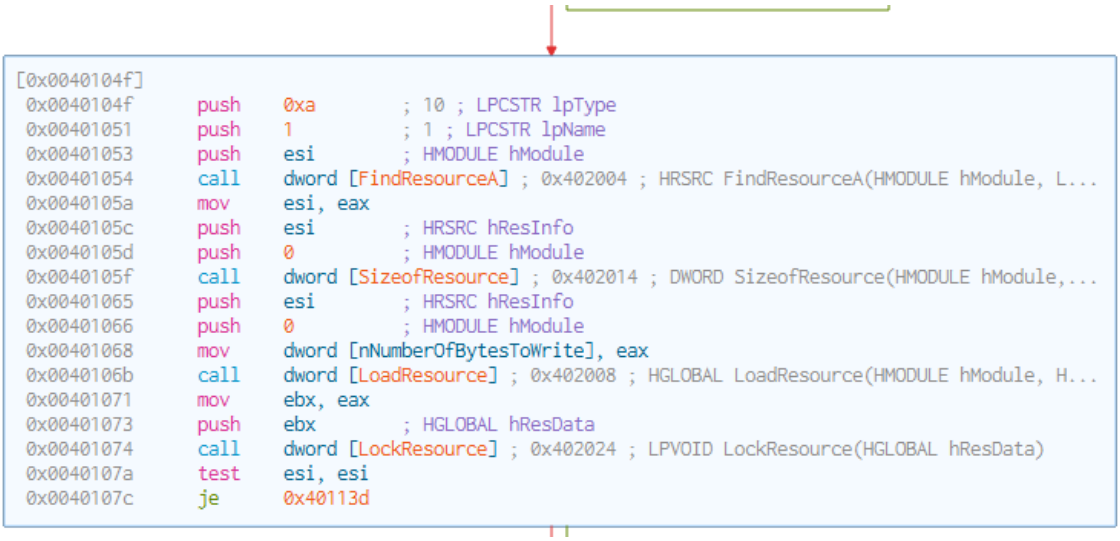
The result is this 


```
C++

int MessageBoxA(
  [in, optional] HWND   hWnd,
  [in, optional] LPCSTR lpText,
  [in, optional] LPCSTR lpCaption,
  [in]           UINT   uType
);
```

5- Xor eax, eax: This is a common idiom for zeroing out a register, set the `eax` register to 0 and then return from a subroutine.

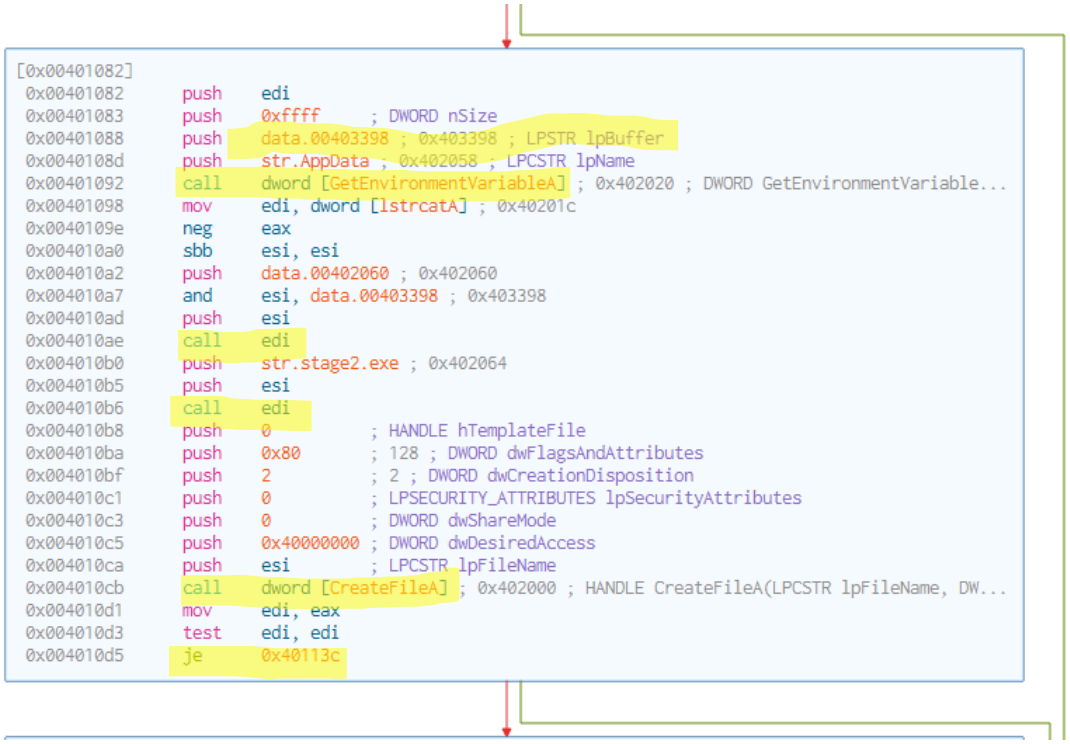
Analyzing function **0x00401000**:



```
[0x0040104f]
 0x0040104f      push    0xa             ; 10 ; LPCSTR lpType
 0x00401051      push    1               ; 1 ; LPCSTR lpName
 0x00401053      push    esi             ; HMODULE hModule
 0x00401054      call    dword [FindResourceA] ; 0x402004 ; HRSRC FindResourceA(HMODULE hModule, L...
 0x0040105a      mov     esi, eax
 0x0040105c      push    esi             ; HRSRC hResInfo
 0x0040105d      push    0               ; HMODULE hModule
 0x0040105f      call    dword [SizeofResource] ; 0x402014 ; DWORD SizeofResource(HMODULE hModule,...
 0x00401065      push    esi             ; HRSRC hResInfo
 0x00401066      push    0               ; HMODULE hModule
 0x00401068      mov     dword [nNumberOfBytesToWrite], eax
 0x0040106b      call    dword [LoadResource] ; 0x402008 ; HGLOBAL LoadResource(HMODULE hModule, H...
 0x00401071      mov     ebx, eax
 0x00401073      push    ebx             ; HGLOBAL hResData
 0x00401074      call    dword [LockResource] ; 0x402024 ; LPVOID LockResource(HGLOBAL hResData)
 0x0040107a      test    esi, esi
 0x0040107c      je      0x40113d
```

1- FindResourceA
2- SizeOfResource
3- LoadResource
4- LockResource

In this code: it Locate a resource within the executable and obtain a handle to the resource information. Then, determine its size and load it into memor(When you call `LoadResource`, it loads the specified resource (identified by the `HRSRC` handle) into memory, and it returns a handle (`HGLOBAL`) to the memory block where the resource is loaded. This handle allows you to access and manipulate the resource's data.).
Finally, obtain a pointer to the resource, allowing access to it and enabling its use.



1- **GetEnviromentalVariableA**: First it get the environment variable in which the resource would be unpacked to which is in AppData, and we see that there is a buffer:

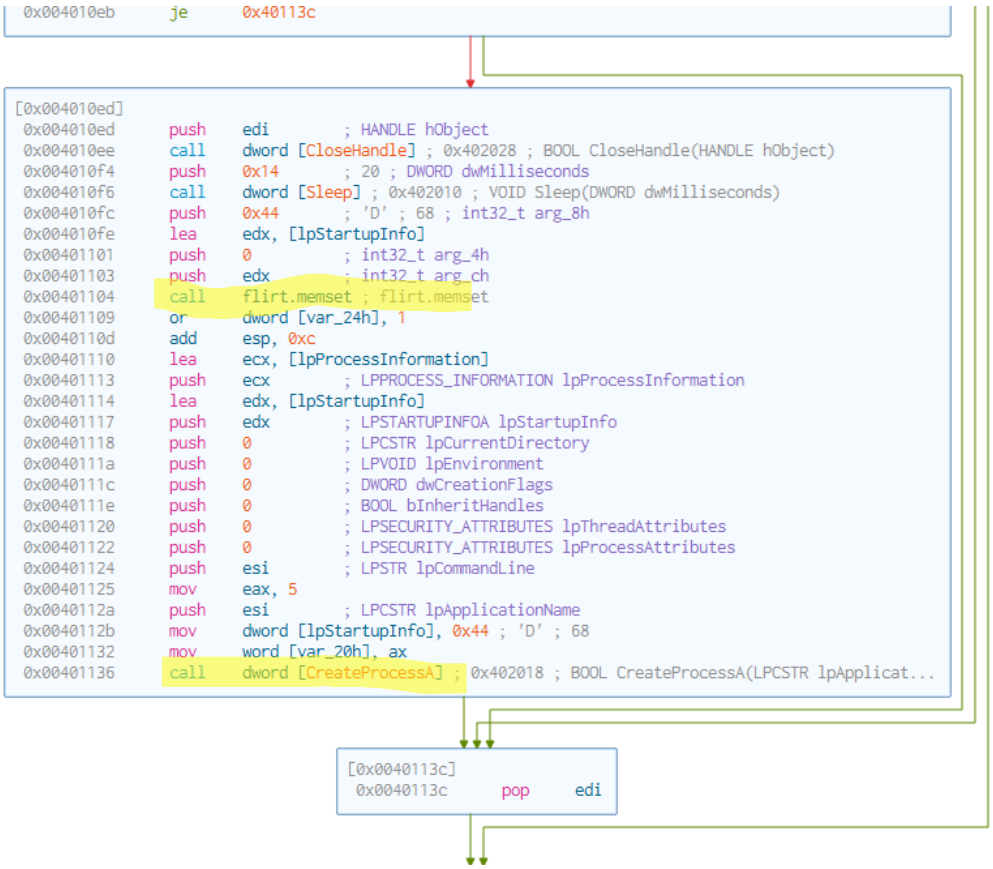
`call edi` is telling the processor to jump to the address stored in the `edi` register, treating it as the starting address of a subroutine. The return address (the address of the instruction following the `call edi` instruction) is pushed onto the stack, allowing the program to return to that address after the subroutine completes.

2- **WriteFile and CreateFile**:This code is creating a file which is stage2.exe and save it in as seeing from string in **C:/Users/Howl/AppData/Roaming.**

`CreateFile` is used for creating or opening files, obtaining a handle to them, and setting up the necessary parameters. Once you have a file handle obtained through `CreateFile`, you can use `WriteFile` to write data to that file. `WriteFile` is specifically focused on the act of writing data, while `CreateFile` is focused on obtaining a handle to a file or creating/opening a file.

Then the result of the creation file is stored in eax then to edi and tested on a jump function. If the ZF is set Jump if equal is taken, and only ZF is set when the result of the writefunction is 0, then ZF set to 1 and then the program is exited by following the condition call and jumped to **0x40113c.**

If the ZF is not set then the program continuous to execute:



1- It call flirt.memset
2- Create a process
3- Call a function to terminate any running functions.

Stage2.exe: Function 0x00401000:

C++

```
BOOL InternetReadFile(
  [in]  HINTERNET hFile,
  [out] LPVOID    lpBuffer,
  [in]  DWORD     dwNumberOfBytesToRead,
  [out] LPDWORD   lpdwNumberOfBytesRead
);
```

In this function its open a connection to definitely_not_evil.com and its requesting an html page and then it reads the file and store it in ebx register and at the end it closes the handle. the result of the Read file function is saved into EAX

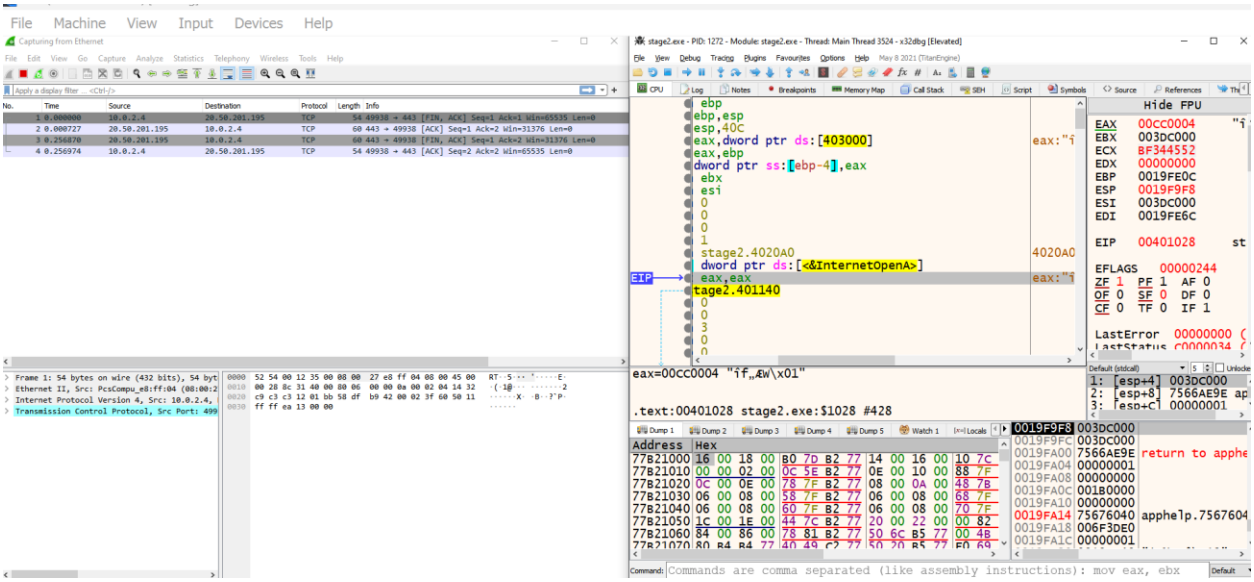
Advanced Dynamic Analysis

Running Stage2.exe in a debugger:

When reaching to the entry point, we saw a call to function 0x401000 and then we saw multiple comparison of the result of that function:

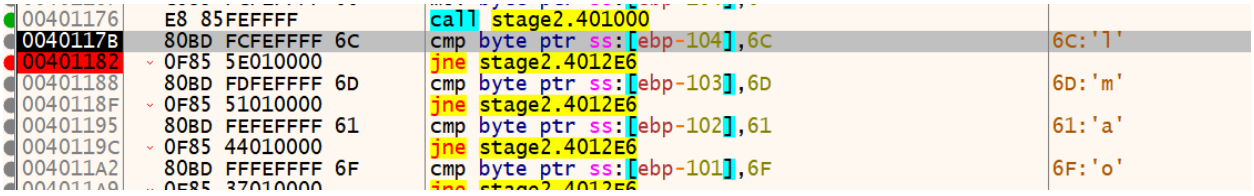
```
0040116F   C685 FCFEFFFF 00     mov byte ptr ss:[ebp-104],0
00401176   E8 85FEFFFF          call stage2.401000
0040117B   80BD FCFEFFFF 6C     cmp byte ptr ss:[ebp-104],6C      6C:'l'
00401182   0F85 5E010000        jne stage2.4012E6
00401188   80BD FDFEFFFF 6D     cmp byte ptr ss:[ebp-103],6D      6D:'m'
0040118F   0F85 51010000        jne stage2.4012E6
00401195   80BD FEFEFFFF 61     cmp byte ptr ss:[ebp-102],61      61:'a'
0040119C   0F85 44010000        jne stage2.4012E6
004011A2   80BD FFFEFFFF 6F     cmp byte ptr ss:[ebp-101],6F      6F:'o'
004011A9   0F85 37010000        jne stage2.4012E6
004011AF   8B3D 60204000        mov edi,dword ptr ds:[<&LoadIconA>]   00402060:"`ˆÌuÀ"
004011B5   33DB                 xor ebx,ebx
```

When entering 0x401000 function we saw it open connection and requestion definitely-not-evil.com/l00k_wh4t_y0u_m4d3_m3_d0



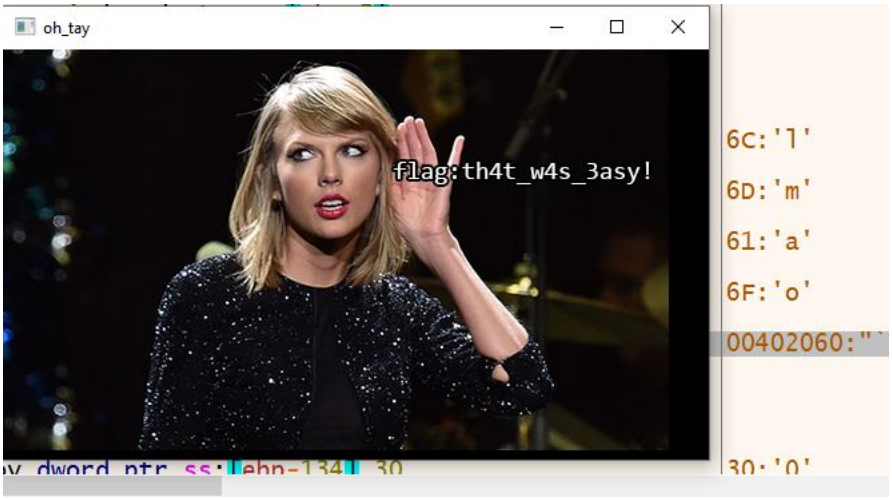
Unknown_RE1012018.zip
Feb 2024
v1.0

Open a connection to Definitely not evit.com then requesting /Look_what_you_made_me_do



The **HttpSendRequest** function is typically used after **HttpOpenRequest** to actually send the HTTP request to the server.

Then it compares the result to “lmao”, and if it’s the same then the last message box is showed:

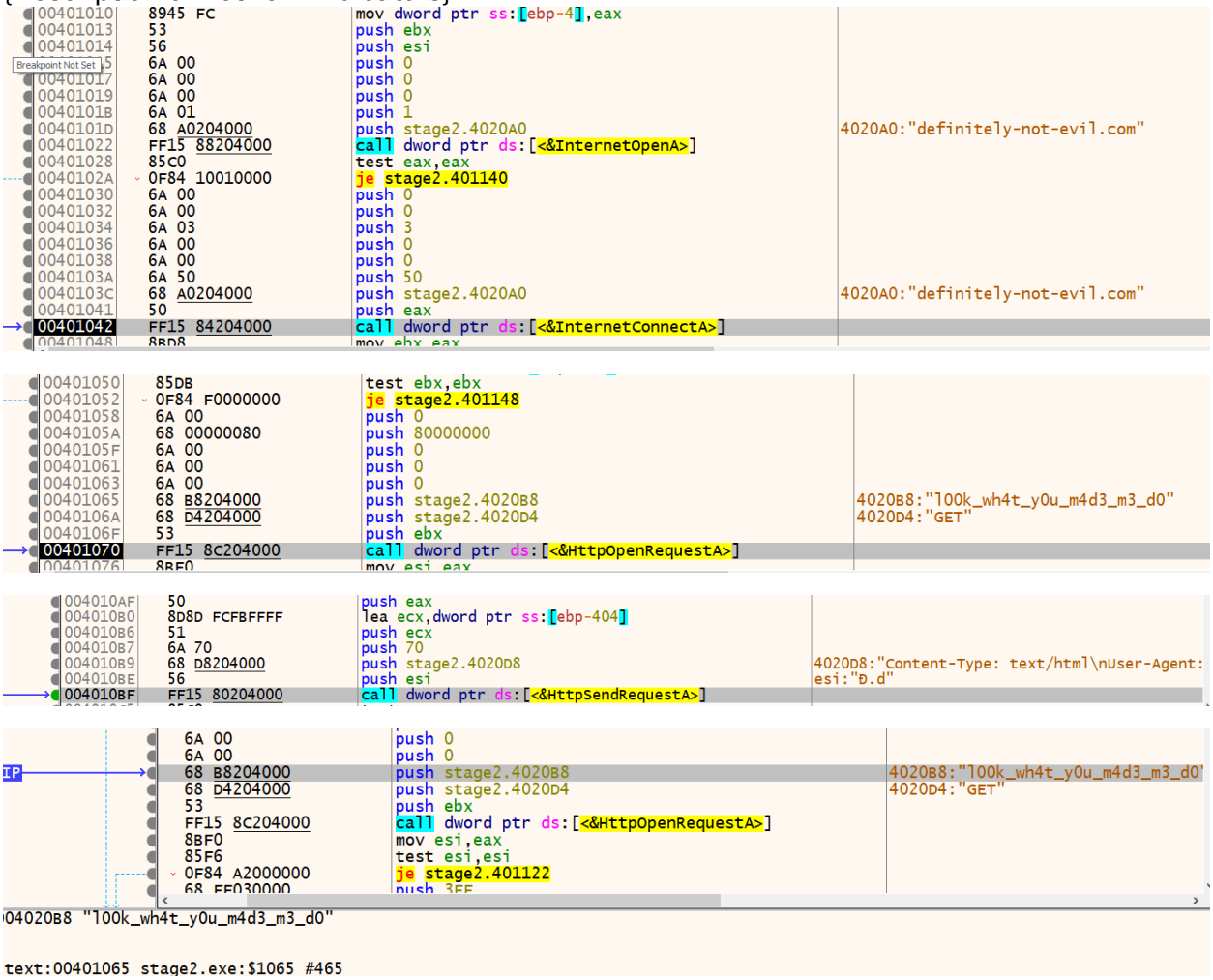


Indicators of Compromise

The full list of IOCs can be found in the Appendices.

Network Indicators

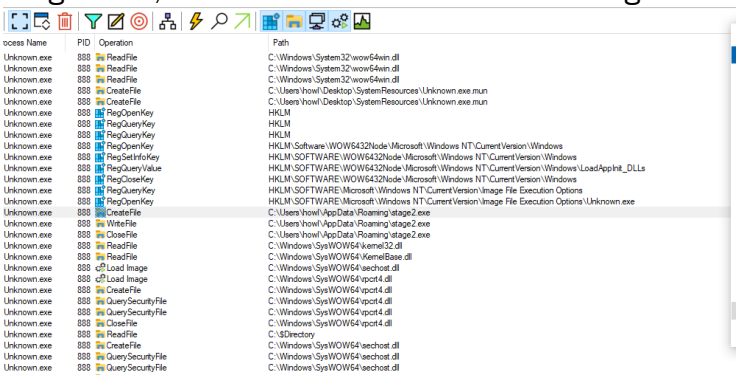
{Description of network indicators}

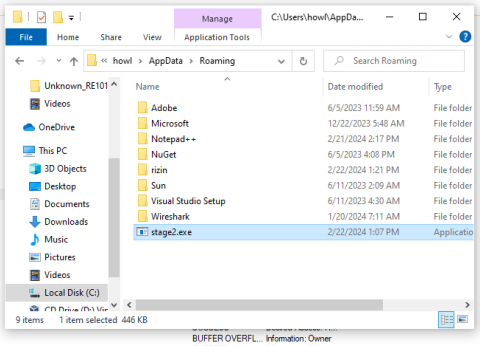


Using InternetConnectA, HttpOpenReqesrtA and HttpSendRequestA to definitely-not-evil.com

Host-based Indicators

Stage2.exe, this file is executed as second stage:





Unknown_RE1012018.zip
Feb 2024
v1.0

Appendices

A. Yara Rules

```
rule YARA_example {
    meta:
        description = "Unknown_RE1012018"
        sha256 =
"927304273321A1C4CCFC0D0580834DAEF98121EFA9BB8963DA332BFD6CF1FDA8A"

    strings:
        $string1="hflagh{i_shtay_hout_htoo_hlateh_goth_nothhingh_in_hmy_bhrainj}"
ascii
        $string2 = "Im totally malware" ascii
        $string3="Dimmaletyoufinishbut" ascii
        $string4="stage2.exe" ascii
        $URL1="definitely-not-evil.com" ascii
        $URL2="l00k_wh4t_y0u_m4d3_m3_d0" ascii
        $IS_PE_FILE="MZ"ascii


    condition:
        $IS_PE_FILE at 0  and
        ($string1 and $string2 and $string3 and $string4 ) or ($URL1 or $URL2)



}
```

B. Callback URLs

Domain	Port
definitely-not-evil.com	80