IAANSEC

APRIL 2022


# WANNACRY RANSOMWARE REPORT

**REPORT BY:**

Jonathan S.

# TABLE OF CONTENTS

# EXECUTIVE SUMMARY

## SHA-256

24d004a104d4d54034dbcffc2a4b19a11f39008
a575aa614ea04703480b1022c

Wannacry is ransomware that utilized the EternalBlue exploit to propagate through the targets network and attacked outdated Windows computers globally in May of 2017. WannaCry was a multistage attack starting with a dropper that unpacked a payload onto the targets system under the right conditions. Once the files were encrypted, the threat actors demanded a ransom of $300 worth of Bitcoin. If the ransom is not paid in a specified amount of time, the ransom is increased to $600. This attack infected around 230,000 computers across 150 countries. Marcus Hutchins later discovered a kill switch that stalled the spread of the attack. Click here to view the full analysis report or scan the QR code above or visit the link below.

https://bit.ly/3JnXpd3

# HIGH-LEVEL TECHNICAL SUMMARY

**For the 12 months to December 1, 2025**

WannaCry consists of 2 stages, the first stage being a dropper that tries to make contact with a suspicious URL that can be found in the strings *hxxp[://]iuqerfsodp9ifjaposdfjhgosurijfaewrwergwea[.]com* if a connection is established the program exits, if a connection is not established the program proceeds with the rest of the execution. Once the program proceeds with execution a service is created by the program *mssecsvc2.0* and has the display name *Microsoft Security Center (2.0) Service*. The service also contains a path to the executable *<PATH_TO_WANNACRY>\wannacry.exe -m security*. During this stage, the program will attempt to propagate by reaching out to a large range of IPv4 addresses.

In stage two the payload is unpacked from the dropper and proceeds to create persistence mechanisms such as creating a folder in the *C:\ProgramData\<GENERATED_STRING>* directory and creating a file named tasksche.exe in the *C:\Windows* path and copying itself to the newly created directory. Once the file has been copied to the directory, a service is created and is named after the same generated string as the newly created folder and contains a path leading to the payload *C:\ProgramData\<GENERATED_STRING>\tasksche.exe*. After the service is created and the payload is executed the encryption process starts which changes the background image, drops instructions on how to decrypt the files, and more in the generated directory.

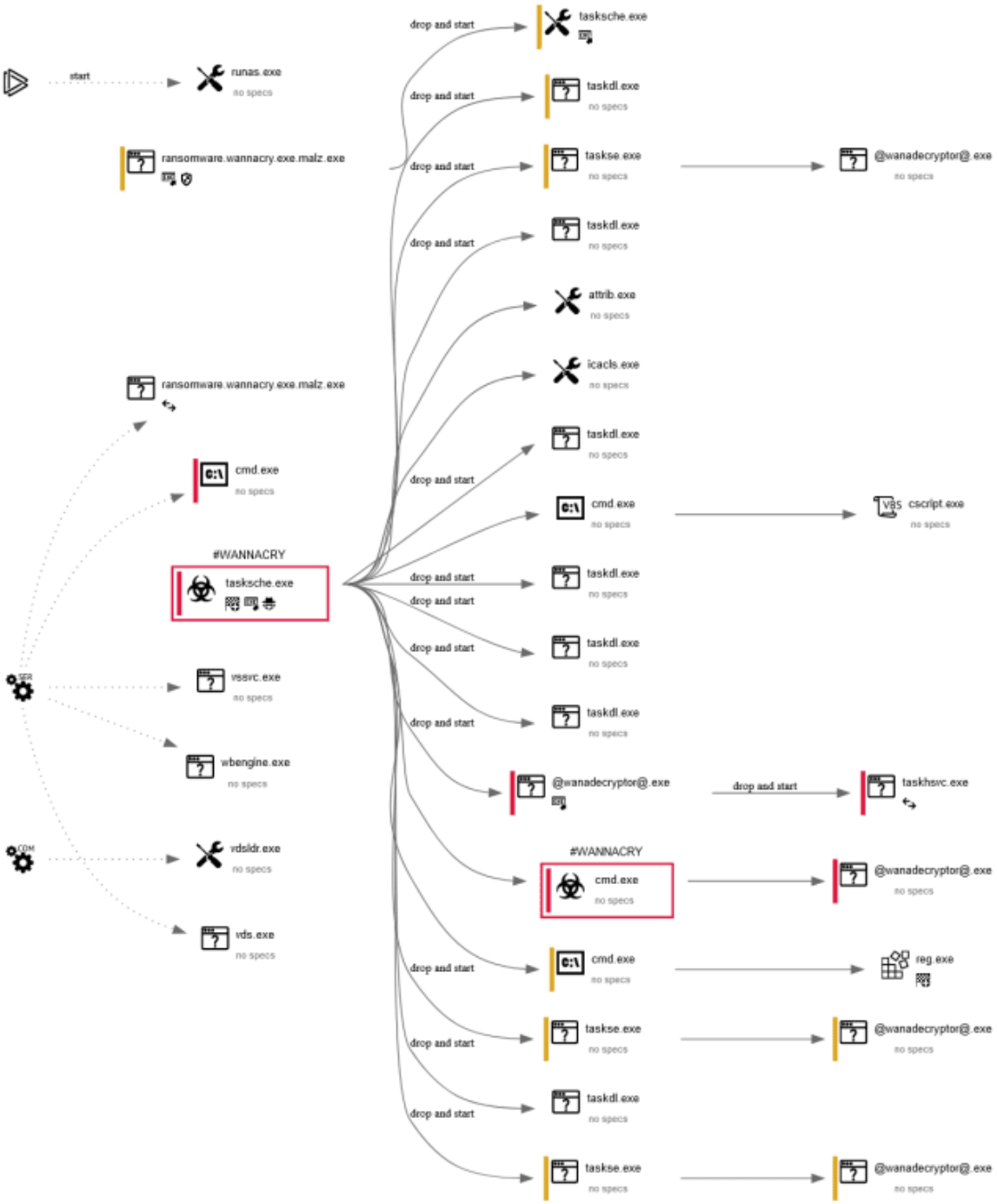



*Fig.1 Execution flow graph*

# MALWARE COMPOSITION

| ITEM | Description | SHA-256 |
|---|---|---|
| Ransomware.wannacry.exe | Initial file detonated | 24d004a104d4d54034dbcffc2a4b19a11f39008a575aa614ea04703480b1022c |
| tasksche.exe | The payload unpacked from the dropper | ed01ebfbc9eb5bbea545af4d01bf5f1071661840480439c6e5babe8e080e41aa |
| @WanaDecryptor@[.]exe | The GUI application that is executed by tasksche after all files have been encrypted and handles ransom payment | b9c5d4339809e0ad9a00d4d3dd26fdf44a32819a54abf846bb9b560d81391c25 |
| taskdl.exe | SQL Client Configuration Utility EXE | 4a468603fdcb7a2eb5770705898cf9ef37aade532a7964642ecd705a74794b79 |
| taskhsvc.exe | Handles communication to TOR URL and other TOR activites | e48673680746fbe027e8982f62a83c298d6fb46ad9243de8e79b7e5a24dcd4eb |
| taskse.exe | Waitfor - Wait/send a signal over a network | 2ca2d550e603d74dedda03156023135b38da3630cb014e3d00b1263358c5f00d |

# STATIC ANALYSIS

## Summary

Analyzing the strings reveals a suspicious URL, later on during the advanced static analysis phase, we can see that the URL is moved to the ESI register and later pushed to the stack as it is used as a parameter in the InternetOpenUrlA function. After the InternetOpenUrlA function has been called, the dropper checks to see if the connection to the URL was successful or not. If the connection succeeds the program exits, otherwise the program continues with execution as seen in *(Fig.2)*. The original filename *(Ihdfrgui.exe)* of the dropper can be found in the "Version" tab of PE Studio *(Fig.3)*. Upon further inspection of the dropper, the date the executable was compiled was also spotted *(Fig.4)*. Heading over to the "Imports" tab of PE Studio, we can see that the dropper utilizes a few network, cryptography, and services functions such as the imports shown in the imports section to the right. The full list of imports can be found in *(Fig.7).* While inspecting the droppers' headers, an executable was spotted in the .rsrc header as shown in *(Fig.5)*.

While analyzing the dropper in Cutter, a reference to the payload *(tasksche.exe)* is seen being pushed to the stack along with the location the payload will be dropped which is the *C:\Windows* location *(Fig.6)*. There is a reference to a file named *"qeriuwjhrf"* in the same location the payload will be dropped, upon further investigation there was no such file created *(Fig.6)*. Bitcoin addresses were also found in the payload *(Fig.8)*.

IMPORTS

- InternetOpenA: InternetOpenA is used to initialize the use of WinINet functions.
- InternetOpenUrlA: InternetOpenUrlA is used to open a resource specified by a complete FTP or HTTP URL.
- CryptGenRandom: CryptGenRandom is used to fill a buffer with cryptographically random bytes.
- CreateServiceA: CreateServiceA is used to create a service object and adds it to the specified service control manager database. This function is commonly used by malware for persistence.
- StartServiceCtrlDispatcherA: StartServiceCtrlDispatcherA is used by a service to connect the main thread of the process to the service control manager.
- connect: Connect is used to establish a connection to a specified socket.
- socket: Socket is used to create a socket that is bound to a specific transport service provider.

# STATIC ANALYSIS

## Images


*FIG.2 REFERENCE TO DNS QUERY URL STRING.*

# STATIC ANALYSIS

## Images

| | |
|---|---|
| FileDescription | Microsoft® Disk Defragmenter |
| FileVersion | 6.1.7601.17514 (win7sp1_rtm.101119-1850) |
| InternalName | lhdfrgui.exe |
| LegalCopyright | © Microsoft Corporation. All rights reserved. |
| OriginalFilename | **lhdfrgui.exe** |
| ProductName | Microsoft® Windows® Operating System |
| ProductVersion | 6.1.7601.17514 |

*FIG.3 ORIGINAL NAME OF DROPPER.*

| | | |
|---|---|---|
| compiler-stamp | 0x4CE78ECC | Sat Nov 20 09:03:08 2010 \| UTC |

*FIG.4 TIMESTAMP THE DROPPER WAS COMPILED.*

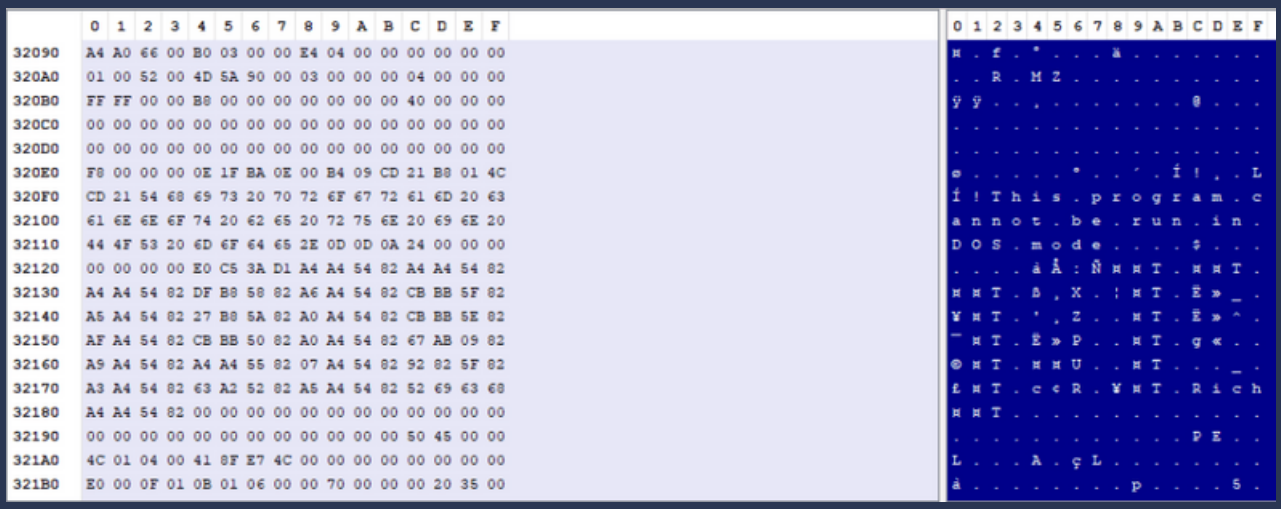



*FIG.5 IMAGE OF EXECUTABLE IN THE .RSRC HEADER OF THE DROPPER.*

# STATIC ANALYSIS

## Images

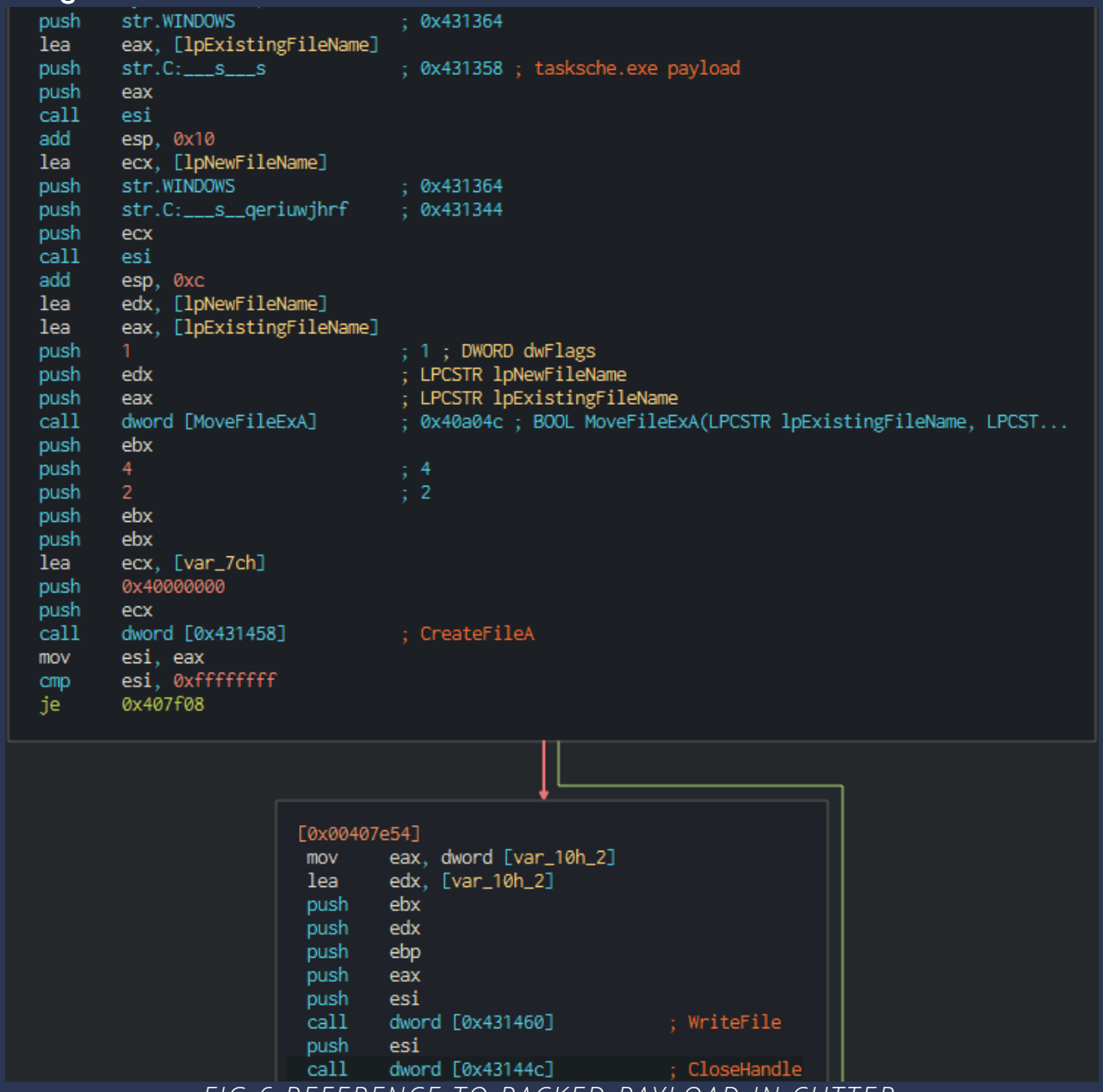



*FIG.6 REFERENCE TO PACKED PAYLOAD IN CUTTER.*

# STATIC ANALYSIS

## Images

| functions (91) | blacklist (29) | anonymous (13) | library (7) |
|---|---|---|---|
| GetCurrentThreadId | x | - | kernel32.dll |
| GetCurrentThread | x | - | kernel32.dll |
| MoveFileExA | x | - | kernel32.dll |
| TerminateThread | x | - | kernel32.dll |
| QueryPerformanceFrequency | x | - | kernel32.dll |
| StartServiceCtrlDispatcherA | x | - | advapi32.dll |
| ChangeServiceConfig2A | x | - | advapi32.dll |
| CreateServiceA | x | - | advapi32.dll |
| CryptGenRandom | x | - | advapi32.dll |
| CryptAcquireContextA | x | - | advapi32.dll |
| 3 (closesocket) | x | x | ws2_32.dll |
| 16 (recv) | x | x | ws2_32.dll |
| 19 (send) | x | x | ws2_32.dll |
| 8 (htonl) | x | x | ws2_32.dll |
| 14 (ntohl) | x | x | ws2_32.dll |
| 115 (WSAStartup) | x | x | ws2_32.dll |
| 12 (inet_ntoa) | x | x | ws2_32.dll |
| 10 (ioctlsocket) | x | x | ws2_32.dll |
| 18 (select) | x | x | ws2_32.dll |
| 9 (htons) | x | x | ws2_32.dll |
| 23 (socket) | x | x | ws2_32.dll |
| 4 (connect) | x | x | ws2_32.dll |
| 11 (inet_addr) | x | x | ws2_32.dll |
| GetAdaptersInfo | x | - | iphlpapi.dll |
| InternetOpenA | x | - | wininet.dll |
| InternetOpenUrlA | x | - | wininet.dll |
| InternetCloseHandle | x | - | wininet.dll |
| rand | x | - | msvcrt.dll |
| srand | x | - | msvcrt.dll |

*FIG.7 IMPORTS OF INTEREST IN THE DROPPER.*

```
mov dword ptr ss:[ebp-C],tasksche.40F48  40F488:"13AM4VW2dhxYgXeQepoHkHSQuy6NgaEb94"
mov dword ptr ss:[ebp-8],tasksche.40F46  40F464:"12t9YDPgwueZ9NyMgw519p7AA8isjr6SMw"
mov dword ptr ss:[ebp-4],tasksche.40F44  40F440:"115p7UMMngoj1pMvkpHijcRdfJNXj6LrLn"
```

*FIG.8 BITCOIN ADDRESSES FOUND IN THE PAYLOAD*

# DYNAMIC ANALYSIS

## Summary

Once the dropper is executed as administrator, a DNS query is made to the suspicious *(hxxp[://]iuqerfsodp9ifjaposdfjhgosurijfaewrwergwea[.]com)* URL mentioned in *(Fig.2).* As stated in the static analysis section, if the dropper receives an HTTP 200 response, the program exits. If the program does not receive a response from the DNS query the program proceeds with the rest of the execution. We can see the dropper making the DNS query in Wireshark shown in *(Fig.9).* After the DNS query the dropper proceeds and pushes two arguments to the stack *<PATH_TO_WANNACRY>* and *-m security* which are then passed as parameters to the CreateServiceA function. The strings *mssecsvc2.0* and *Microsoft Security Center (2.0) Service* are also pushed to the stack in preparation for the creation of the service. The program proceeds to create a service named *mssecsvc2.0* with the display name of *Microsoft Security Center (2.0) Service* as seen in *(Fig.10).* After the service is created and executed, the dropper attempts to connect to a range of IPv4 addresses on port 445 (SMB) using the EternalBlue exploit *(Fig.11).* As the dropper attempts to connect to the range of IPv4 addresses, the payload is being unpacked from the dropper and is executed *(Fig.12)*. The payload generates a string based on the hostname of the system and creates a folder named after the generated string in the *C:\ProgramData* directory.

After the creation of the directory, a copy of the payload is moved to the directory and executed along with *attrib +h .* to hide the current directory the payload was copied along with *icacls . /grant Everyone:F /T /C /Q* to grant full permissions to the directory *(Fig.13)*. Along with the creation of the new directory, a service is also created with the same generated name as the directory which uses cmd to execute *tasksche* as a persistence mechanism *(Fig.14)*. Once the service is created, a registry key named *WanaCrypt0r* and registry key value named *wd* are created with the key-value set to the newly created directory in *C:\ProgramData\<RANDOMLY_GENERATED_STRING>* *(Fig.15).* After the payload has been executed by cmd, the encryption process begins. An executable named *WanaDecryptor@.exe* is dropped along with various other files in the same directory as the payloads' execution and creates a shortcut to the @WanaDecryptor executable on the Desktop *(Fig.16)*. Lastly, the system background is changed and a GUI of the *@WanaDecryptor@.exe* executable is displayed *(Fig.17). (Note) The following strings can be found in the c.wnry file dropped by the payload:*

- *gx7ekbenv2riucmf.onion*
- *57g7spgrzlojinas.onion*
- *xxlvbrloxvriy2c5.onion*
- *76jdd2ir2embyv47.onion*
- *cwwnhwhlz52maqm7.onion*
- *https://dist.torproject.org/torbrowser/6.5.1/tor-win32-0.2.9.10.zip*

# DYNAMIC ANALYSIS

## Images

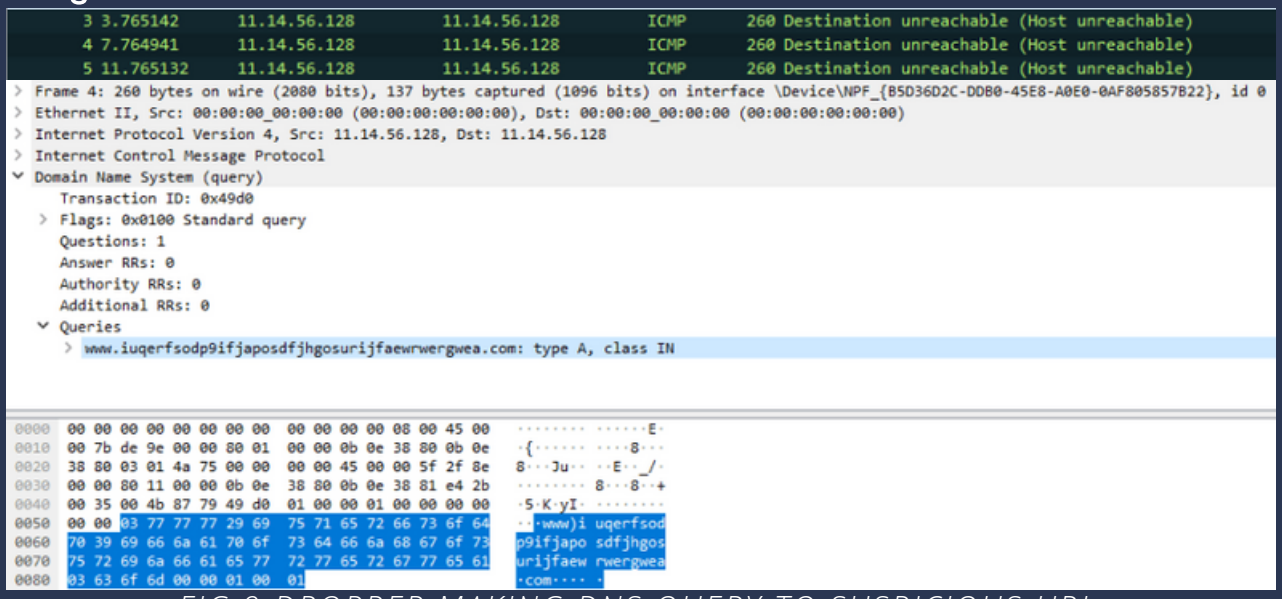



*FIG.9 DROPPER MAKING DNS QUERY TO SUSPICIOUS URL.*

# DYNAMIC ANALYSIS

## Images

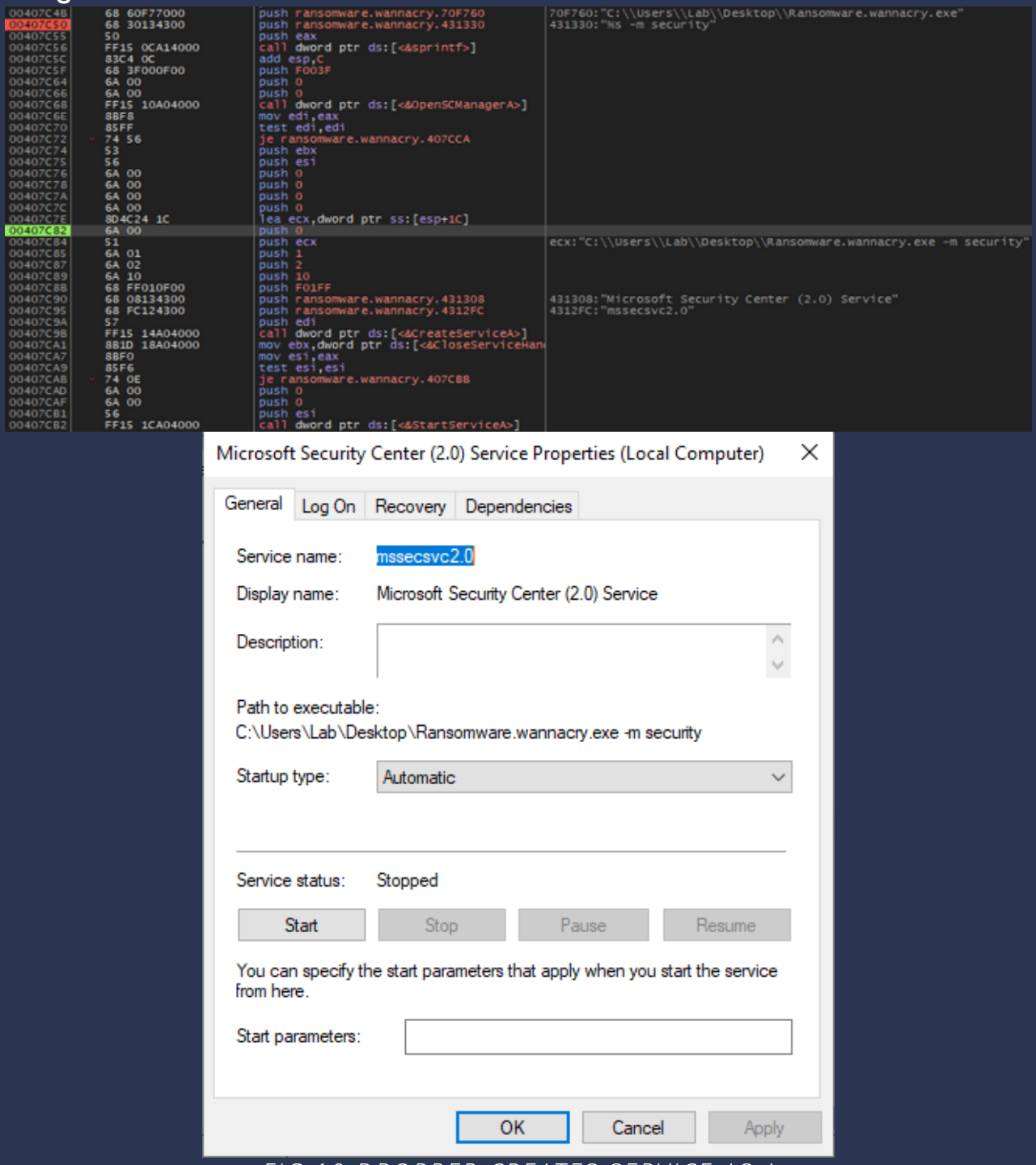
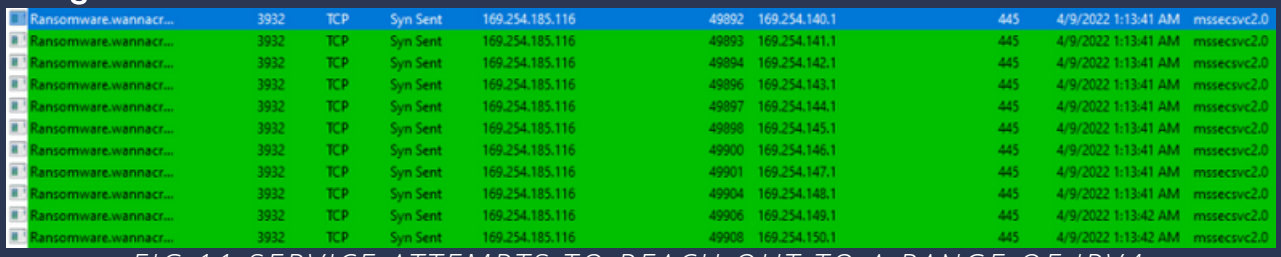



*FIG.10 DROPPER CREATES SERVICE AS A PERSISTENCE MECHANISM*

# DYNAMIC ANALYSIS

## Images



| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Ransomware.wannacr... | 3932 | TCP | Syn Sent | 169.254.185.116 | 49892 | 169.254.140.1 | 445 | 4/9/2022 1:13:41 AM | mssecsvc2.0 |
| Ransomware.wannacr... | 3932 | TCP | Syn Sent | 169.254.185.116 | 49893 | 169.254.141.1 | 445 | 4/9/2022 1:13:41 AM | mssecsvc2.0 |
| Ransomware.wannacr... | 3932 | TCP | Syn Sent | 169.254.185.116 | 49894 | 169.254.142.1 | 445 | 4/9/2022 1:13:41 AM | mssecsvc2.0 |
| Ransomware.wannacr... | 3932 | TCP | Syn Sent | 169.254.185.116 | 49896 | 169.254.143.1 | 445 | 4/9/2022 1:13:41 AM | mssecsvc2.0 |
| Ransomware.wannacr... | 3932 | TCP | Syn Sent | 169.254.185.116 | 49897 | 169.254.144.1 | 445 | 4/9/2022 1:13:41 AM | mssecsvc2.0 |
| Ransomware.wannacr... | 3932 | TCP | Syn Sent | 169.254.185.116 | 49898 | 169.254.145.1 | 445 | 4/9/2022 1:13:41 AM | mssecsvc2.0 |
| Ransomware.wannacr... | 3932 | TCP | Syn Sent | 169.254.185.116 | 49900 | 169.254.146.1 | 445 | 4/9/2022 1:13:41 AM | mssecsvc2.0 |
| Ransomware.wannacr... | 3932 | TCP | Syn Sent | 169.254.185.116 | 49901 | 169.254.147.1 | 445 | 4/9/2022 1:13:41 AM | mssecsvc2.0 |
| Ransomware.wannacr... | 3932 | TCP | Syn Sent | 169.254.185.116 | 49904 | 169.254.148.1 | 445 | 4/9/2022 1:13:41 AM | mssecsvc2.0 |
| Ransomware.wannacr... | 3932 | TCP | Syn Sent | 169.254.185.116 | 49906 | 169.254.149.1 | 445 | 4/9/2022 1:13:42 AM | mssecsvc2.0 |
| Ransomware.wannacr... | 3932 | TCP | Syn Sent | 169.254.185.116 | 49908 | 169.254.150.1 | 445 | 4/9/2022 1:13:42 AM | mssecsvc2.0 |

*FIG.11 SERVICE ATTEMPTS TO REACH OUT TO A RANGE OF IPV4.*

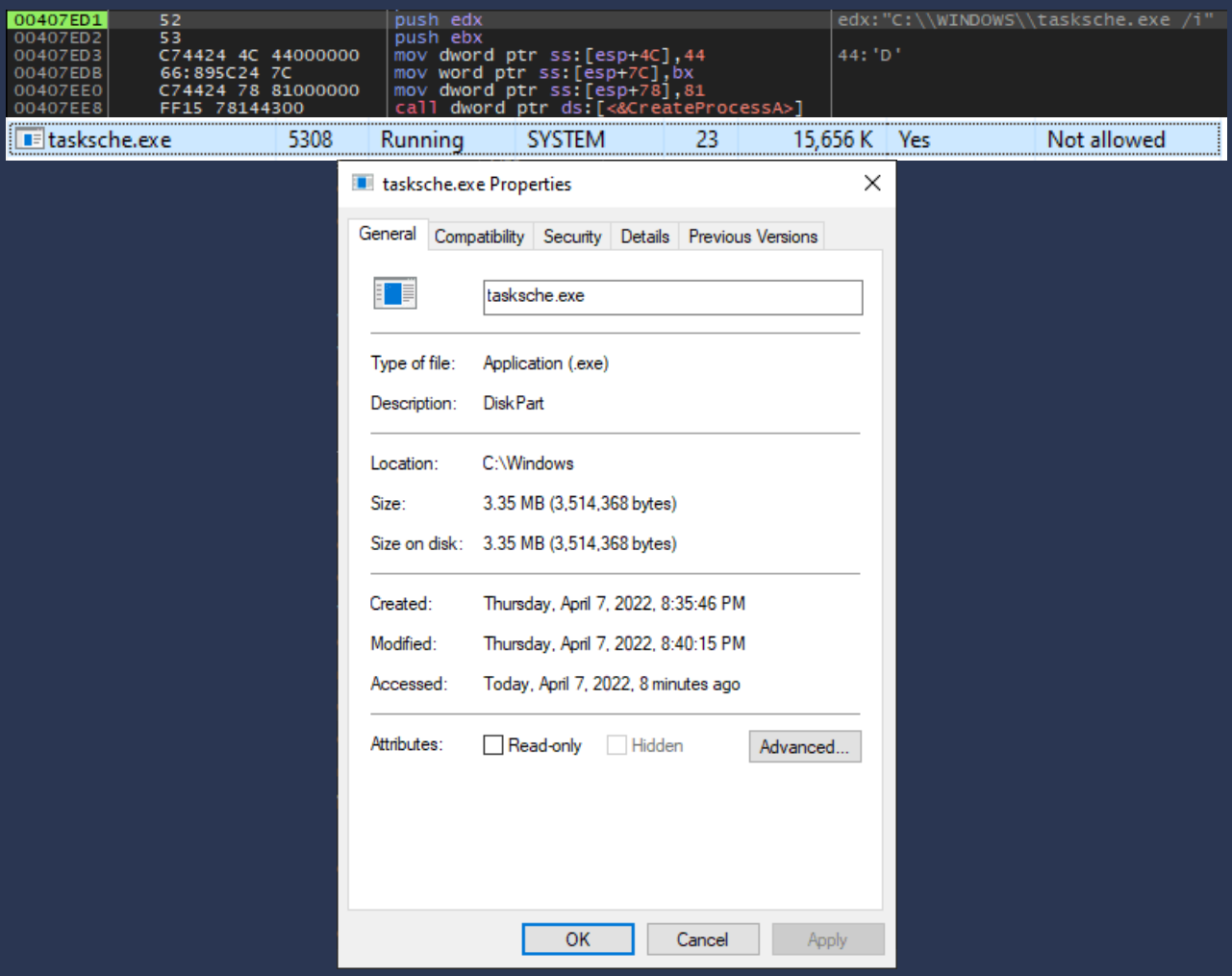



*FIG.12 PAYLOAD IS UNPACKED FROM DROPPER.*

# DYNAMIC ANALYSIS

## Images

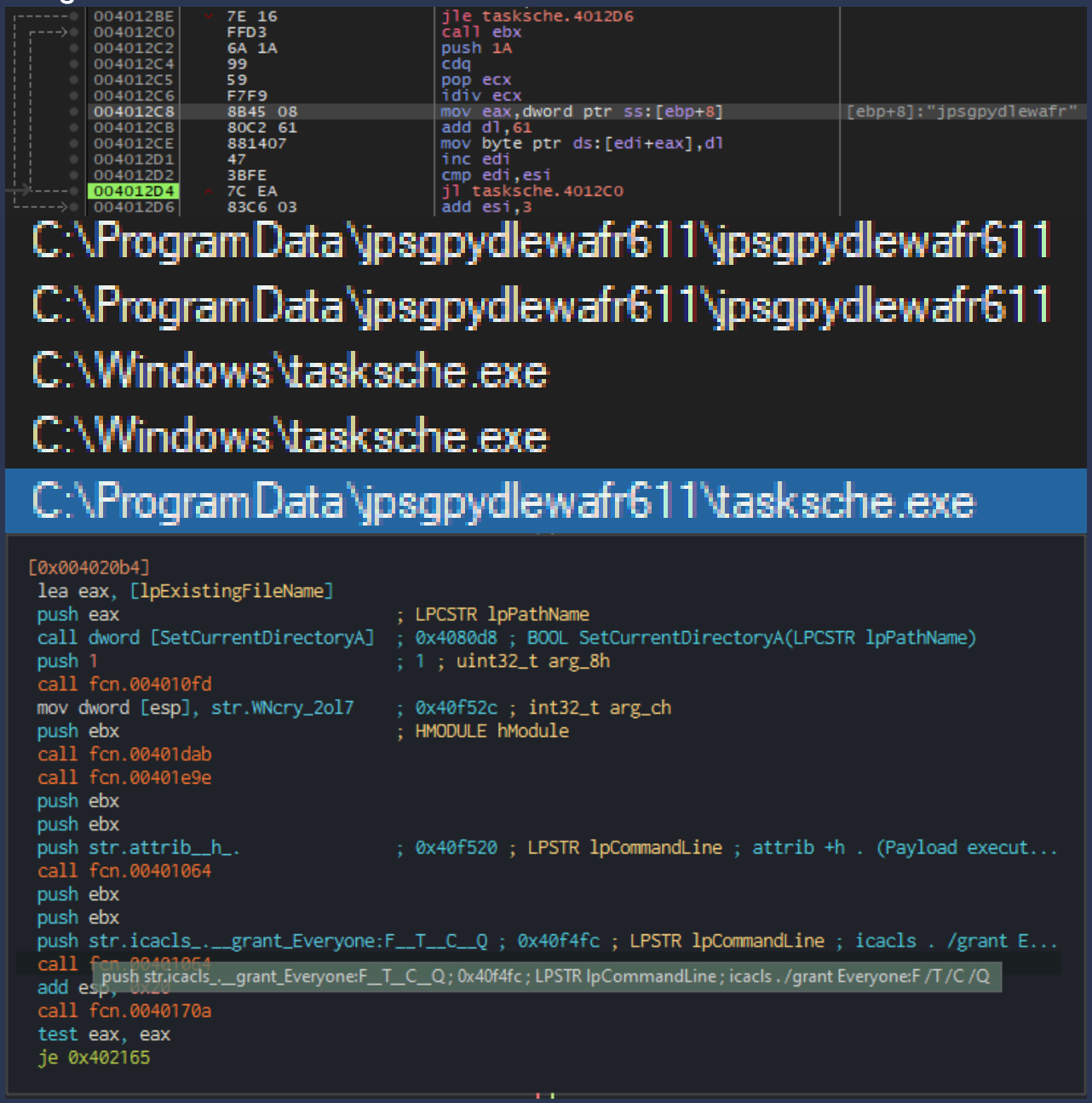



*FIG.13 PAYLOAD CREATES DIRECTORY BASED ON SYSTEM NAME AND ADDS HIDDEN ATTRIBUTE TO FOLDER AND GRANTS PERMISSIONS TO SAID DIRECTORY*

# DYNAMIC ANALYSIS

**Images**

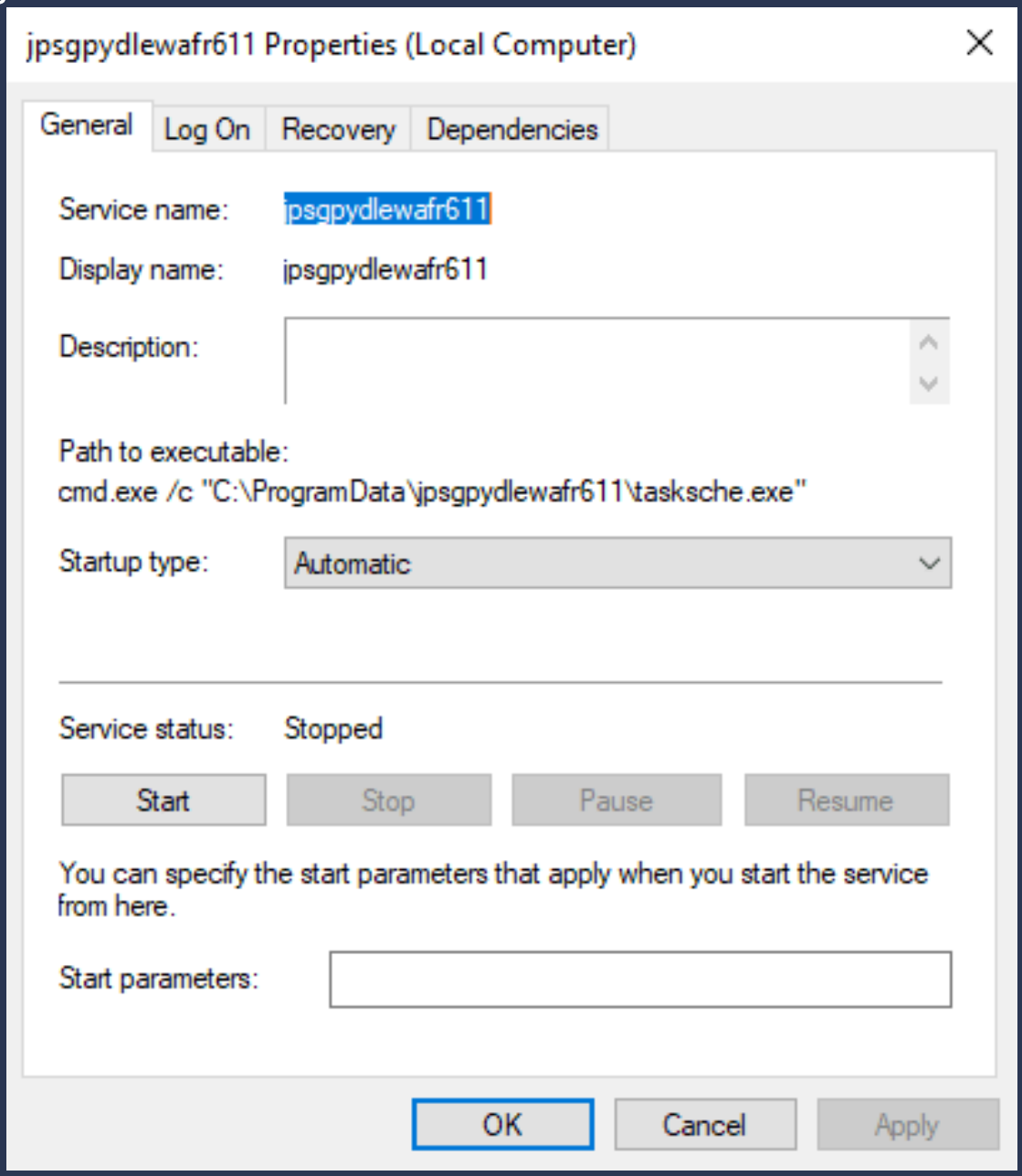



*FIG.14 SERVICE IS CREATED WITH THE SAME NAME AS THE GENERATED STRING.*

# DYNAMIC ANALYSIS

## Images

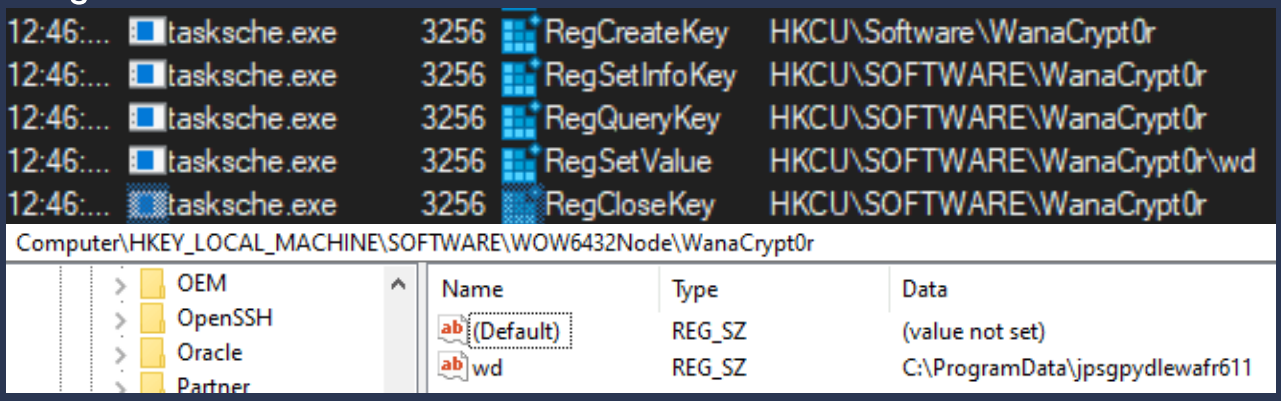
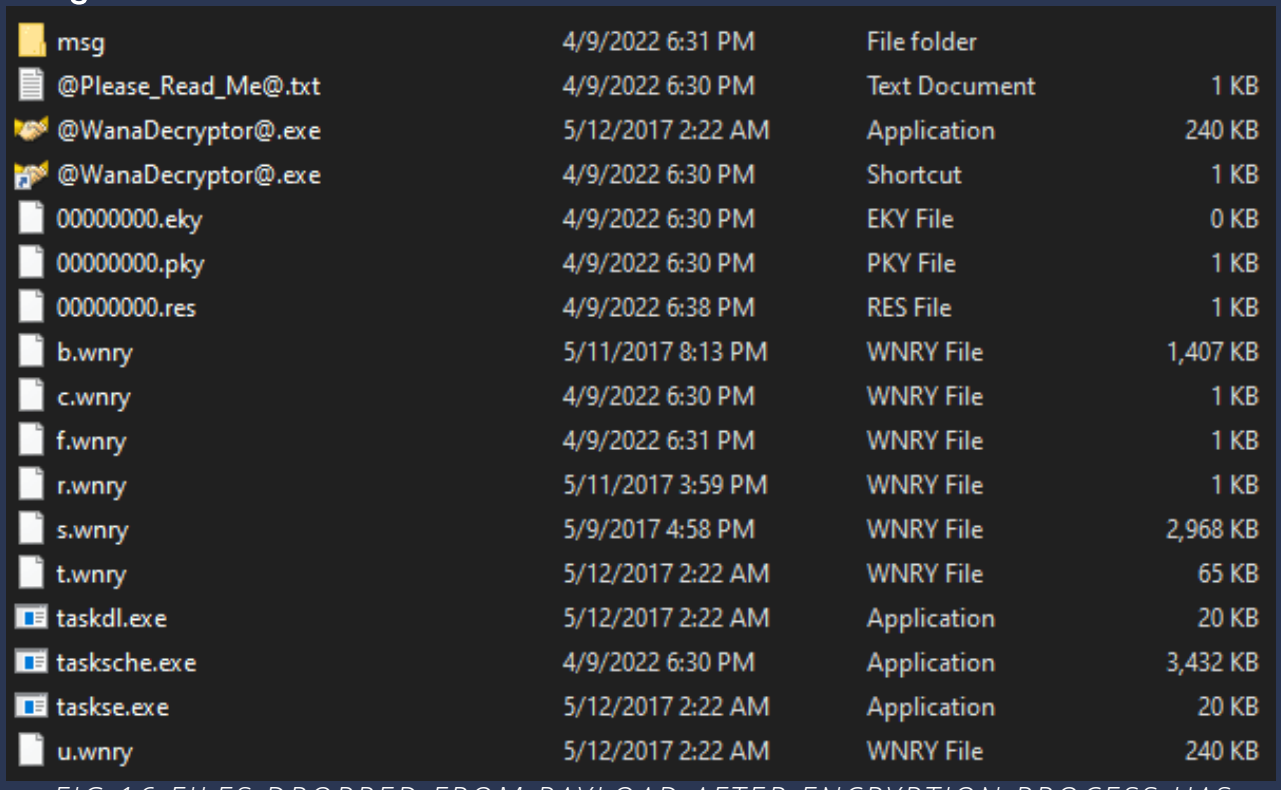



*FIG.15 REGISTRY KEY CREATED BY PAYLOAD SERVICE.*

# DYNAMIC ANALYSIS

## Images



| | | | |
|---|---|---|---|
| msg | 4/9/2022 6:31 PM | File folder | |
| @Please_Read_Me@.txt | 4/9/2022 6:30 PM | Text Document | 1 KB |
| @WanaDecryptor@.exe | 5/12/2017 2:22 AM | Application | 240 KB |
| @WanaDecryptor@.exe | 4/9/2022 6:30 PM | Shortcut | 1 KB |
| 00000000.eky | 4/9/2022 6:30 PM | EKY File | 0 KB |
| 00000000.pky | 4/9/2022 6:30 PM | PKY File | 1 KB |
| 00000000.res | 4/9/2022 6:38 PM | RES File | 1 KB |
| b.wnry | 5/11/2017 8:13 PM | WNRY File | 1,407 KB |
| c.wnry | 4/9/2022 6:30 PM | WNRY File | 1 KB |
| f.wnry | 4/9/2022 6:31 PM | WNRY File | 1 KB |
| r.wnry | 5/11/2017 3:59 PM | WNRY File | 1 KB |
| s.wnry | 5/9/2017 4:58 PM | WNRY File | 2,968 KB |
| t.wnry | 5/12/2017 2:22 AM | WNRY File | 65 KB |
| taskdl.exe | 5/12/2017 2:22 AM | Application | 20 KB |
| tasksche.exe | 4/9/2022 6:30 PM | Application | 3,432 KB |
| taskse.exe | 5/12/2017 2:22 AM | Application | 20 KB |
| u.wnry | 5/12/2017 2:22 AM | WNRY File | 240 KB |

*FIG.16 FILES DROPPED FROM PAYLOAD AFTER ENCRYPTION PROCESS HAS BEGUN.*

# DYNAMIC ANALYSIS

## Images


*FIG.17 BACKGROUND CHANGED AND GUI APPLICATION DISPLAYED*

# INDICATORS OF COMPROMISE

## Network Indicators

- *Dropper observed making DNS Query to a suspicious domain (Fig.9). (hxxp[://]iuqerfsodp9ifjaposdfjhgosurijfaewrwergwea[.]com)*
- *Payload attempts to establish contact with a range of IPv4 addresses (Fig.11).*

# INDICATORS OF COMPROMISE

## Host-Based Indicators

- *Payload is unpacked onto the system in C:\Windows. (Note) During the debugging process, there was a mention of a file in the directory C:\Windows named qeriuwjhrf but the file was never created (Fig.12).*
- *Creation of services mssecsvc2.0 (Fig.10) and a service with a name randomly generated based on the system name (Fig.14).*
- *Creation of registry key HKCU\SOFTWARE\WanaCrypt0r\wd (Fig.15).*
- *Creation of files following the execution of the payload in the same directory as the execution. Along with files ending in the .WNCRY extension (Fig.16).*
- *Background change and appearance of GUI application. (Fig.17).*

# YARA RULES

```
rule wannacry_ruleset {
   meta:
   last_updated = "04-09-2022"
   author = "IAANSEC"
   description = "Yara rule to detect wannacry ransomware."
   hash256 = "24d004a104d4d54034dbcffc2a4b19a11f39008a575aa614ea04703480b1022c"

   strings:
      $MZ_byte = "MZ"
      $querydomain_killswitch = "iuqerfsodp9ifjaposdfjhgosurijfaewrwergwea" ascii
      $weird_windows_dir_str = "qeriuwjhrf" ascii
      $reg_name = "WanaCrypt0r" ascii
      $service = "Microsoft Security Center (2.0) Service" ascii
      $payload = "tasksche" ascii
      $exe1 = "taskdl" ascii
      $exe2 = "taskse" ascii
      $import = "Crypt" ascii
      $str = "WNcry@2017" ascii
      $decrypt_exe = "@WanaDecryptor@.exe" ascii
      $wnry = "wnry" ascii
      $decrypt = "decrypt" ascii
      $bitcoin = "bitcoin" ascii
      $btc_wallet1 = "115p7UMMngoj1pMvkpHijcRdfJNXj6LrLn" fullword ascii
      $btc_wallet2 = "13AM4VW2dhxYgXeQepoHkHSQuy6NgaEb94" fullword ascii
      $btc_wallet3 = "12t9YDPgwueZ9NyMgw519p7AA8isjr6SMw" fullword ascii

   condition:
      $MZ_byte at 0 and
      5 of them
}
```

# CONTACT.


IAANSEC

https://iaansec.com