MALWARE ANALYSIS REPORT

WannaCry Ransomware

MARCH 2022 | V2.0

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Executive Summary

28th February 2022

Wannacry is a ransomware cryptoworm which was used for WannaCry ransomware attack in the year 2017. To propogate this ransomware a well known vulnerability knows as EternalBlue was exploited which was developed by National Security Agency (NSA).

Wannacry ransomware is a x32 bit program written in C++ for Windows Operating system.

The attack consists of 3 stages.

- Drops a 2nd executable by replacing tasksche.exe in the C:\Windows Directory
- 2. The 2nd executable drops the resources like encryption DLL and EXE file, cryptographic keys, bitcoin address etc..
- 3. Creates multiple thread to carry out encryption of files in the victim machine.

The Symptoms of infections include

- 1. Changing of Desktop image to black background with red text.
- 2. Encrypted File with WNCRY extension
- 3. Service with service name mssecsvc.exe and display name MIcrosoft Security Center (2.0) Service
- 4. Presence of Registry Key
 HKLM\SOFTWARE\Wow6432Node\WannaCrypt
 Or

YARA signature rules are attached in the end of the report. Malware sample and hashes have been submitted to VirusTotal for further examination.

High Level Technical Summary

28th February 2022

Wannacry ransomware works on 3 phases

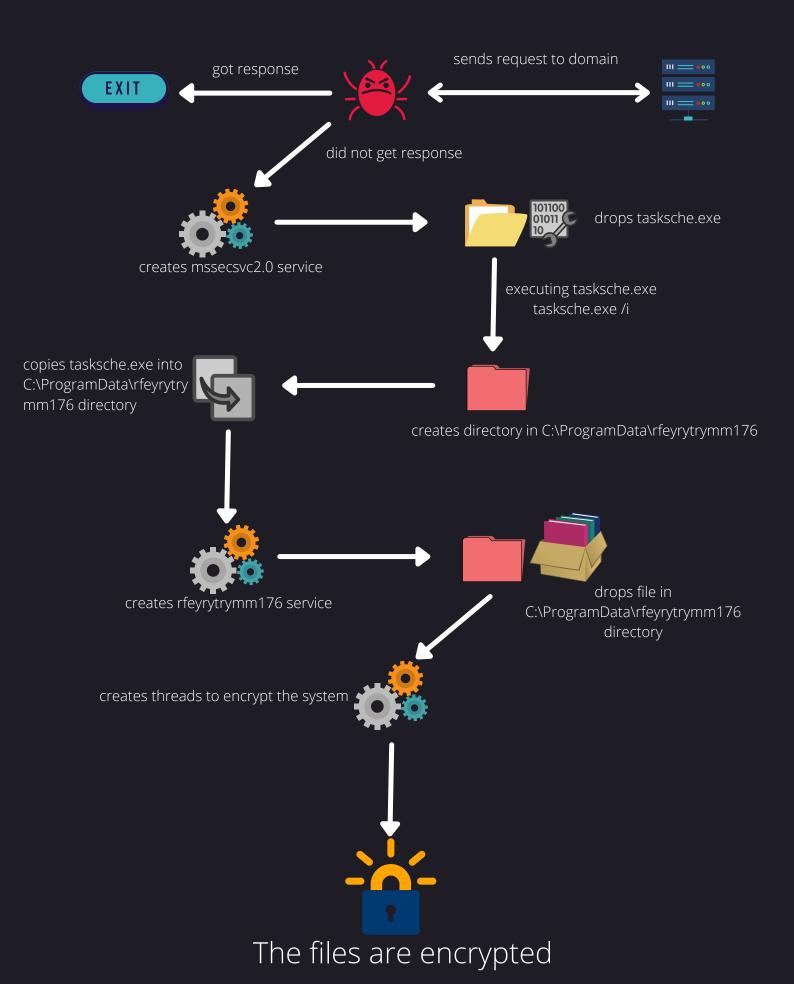
In the 1st phase it tries to reach out to

www[.]iuqerfsodp9ifjaposdfjhgosurijfaewrwergwea[.]com domain which is a kill switch. If the domain respond to the request then wannacry immediately exits and does not execute. If the domain is not active then wannacry will begin the attack by creating a windows service with service name mssecsvc2.0, display name Microsoft Security Center (2.0) Service and binary path "<PATH_TO_WANNACRY>\wannacry.exe -m security". The service will constantly try to reach out to a range of IPv4 addresses.

After creating windows service it checks if tasksche.exe exists or not in C:\Windows directory. If the binary exists then it renames it to qeriuwjhrf.exe and them drops an executable in the C:\Windows directory with name tasksche.exe from it's resource section.

In the 2nd Phase it creates a new process with command line argument "C:\Windows\tasksche.exe /i". /i tells the process to begin the initialisation process. In this initialisation it creates a directory in "C:\ProgramData\rfeyrytrymm176". After creating the directory it will move copy itself to this newly created directory and then creates a service with binary path "C:\ProgramData\rfeyrytrymm176\tasksche.exe". The created service will then proceed with dropping encrypting EXE, DLL, cryptokeys, images, bitcoin address in the "C:\ProgramData\rfeyrytrymm176\" directory.

In the 3rd Phase it creates multiple threads which will process with encrypting all the important files in the local system, changing desktop background, copying instructions to desktop and many more.



Malware Composition

28 February 2022

Wannacry consists of following components

FileName	SHA-1 Hash
wannacry.exe	E889544AFF85FFAF8B0D0DA705105DEE7C97FE26
tasksche.exe	5FF465AFAABCBF0150D1A3AB2C2E74F3A4426467
tasksche_res.zip	30F8820CF93A627C66195F0D77D6A409024C6E52
taskdll.exe	47A9AD4125B6BD7C55E4E7DA251E23F089407B8F
taskse.exe	BE5D6279874DA315E3080B06083757AAD9B32C23

wannacry.exe

The initial executable that runs in the beginning

tasksche.exe

This executable is dropped by wannacry.exe file after execution. It is responsible for creating a directory in the C:\ProgramData directory and copies itself into it in order to drop more files.

tasksche_res.zip

Resides in the resource section of tasksche.exe file which contains executable and files for encryption

taskdll.exe and taskse.exe

These executable are responsible for encrypting files in the local system.

Static Analysis

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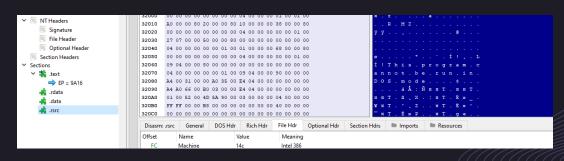
Basic information about the executable using CF Explorer

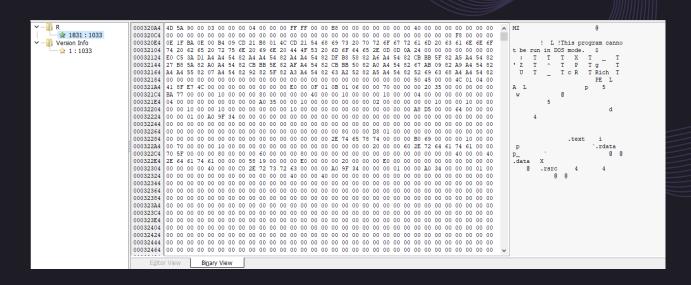
Property	Value	Value			
File Name	C:\Us	C:\Users\Analyst\Desktop\wannacry.exe			
File Type	Porta	ble Executable 32			
File Info	Micro	Microsoft Visual C++ 6.0			
File Size	3.551	3.55 MB (3723264 bytes)			
PE Size	3.55 MB (3723264 bytes)				
Created	Thursday 24 February 2022, 11.13.31				
Modified	Tuesday 19 March 2019, 11.32.14				
Accessed	Monday 28 February 2022, 10.53.58				
MD5	DB349B97C37D22F5EA1D1841E3C89EB4				
SHA-1	E889544AFF85FFAF8B0D0DA705105DEE7C97FE26				
Property		Value			
CompanyName		Microsoft Corporation			
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			

The Time Date Stamp was found using PEstudio tool.

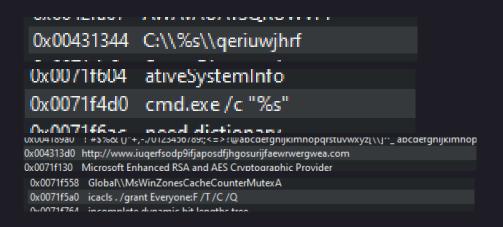
1.5	occions count		•
100	Time Date Stamp	4ce78ecc	Saturday, 20.11.2010 09:03:08 UTC
104	DULI COLUMNIA	0	Δ

Examining sections of wannacry.exe I found out the .rsrc section contains an executable file





Using Cutter we found some intresting strings inside the binary



Some interesting Import functions

Call via	Name	Ordinal	Original Thunk	Thunk	Forwarder	Hint	
A134	InternetOpenA	-	A7DC	A7DC	-	92	
A138	InternetOpenUrlA	-	A7C8	A7C8	-	93	
A13C	InternetCloseHandle	-	A7B2	A7B2	-	69	
Call via	Name	Ordinal	Origi	nal Thunk	Thunk	Forwarder	Hint
A054	TerminateThread	-	A4E4	1	A4E4	-	35F
A058	LoadResource	-	A5A6		A5A6	-	257
A05C	FindResourceA	-	A5B6	A	A5B6	-	E3
A060	GetProcAddress	-	A5C6		A5C6	-	1A0
A064	GetModuleHandleW	-	A5D8	. A	A5D8	-	182
A068	ExitProcess	-	A5EC		A5EC	-	B9
A06C	GetModuleFileNameA	-	A5FA		A5FA	-	17D
Call via	Name	Ordinal	Original Thu	ınk Thunk	Forward	er Hint	
A000	StartServiceCtrlDispatcherA	-	A6F6	A6F6	-	24A	
A004	RegisterServiceCtrlHandlerA	-	A6D8	A6D8	-	20C	
A008	ChangeServiceConfig2A	-	A6C0	A6C0	-	34	
A00C	SetServiceStatus	-	A6AC	A6AC	-	244	
A010	OpenSCManagerA	-	A69A	A69A	-	1AD	
A014	CreateServiceA	-	A688	A688	-	64	
A018	CloseServiceHandle	-	A672	A672	-	3E	

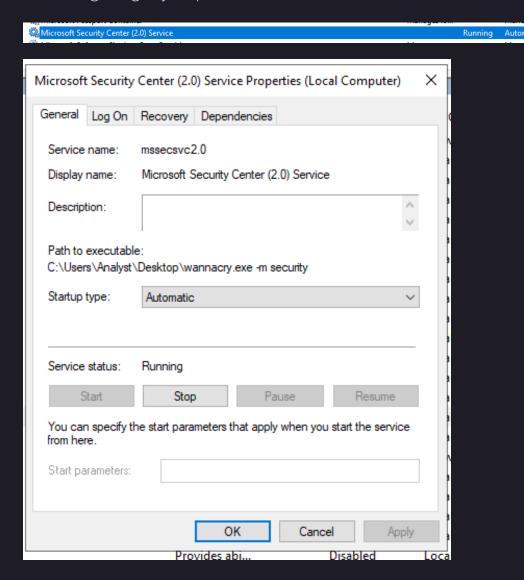
Dynamic Analysis

28th February 2022

When executed the wannacry.exe tries to make a DNS request



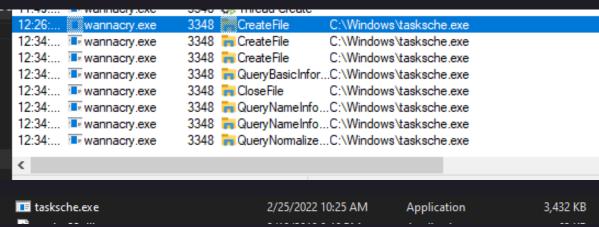
After not getting any response it carries on to create a service.



The newly created service will try to connect to range of IPv4 addresses

```
1:53:... • wannacry.exe
                                                              2872 🛱 Thread Exit
                                                             2872 TCP Reconnect DESKTOP-98I24CQ:58632 -> 169.254.126.7:microsoft-ds 2872 TCP Reconnect DESKTOP-98I24CQ:58633 -> 169.254.127.7:microsoft-ds 2872 TCP Disconnect DESKTOP-98I24CQ:58632 -> 169.254.126.7:microsoft-ds 2872 TCP DIsconnect DESKTOP-98I2
1:53:... • wannacry.exe
1:53:... • wannacry.exe
1:53:... wannacry.exe
1:53:... wannacry.exe
                                                              2872 CThread Exit
1:53:... wannacrv.exe
                                                              2872 TCP Disconnect DESKTOP-98I24CQ:58633 -> 169.254.127.7:microsoft-ds
1:53:... I wannacry.exe
                                                              2872 Thread Exit
1:53:... 📧 wannacry.exe
                                                              2872 TCP Reconnect DESKTOP-98I24CQ:58634 -> 169.254.128.7:microsoft-ds
                                                              2872 TCP Disconnect DESKTOP-98I24CQ:58634 -> 169.254.128.7:microsoft-ds
1:53:... wannacry.exe
                                                              2872 Phread Exit
1:53:... Is wannacry.exe
1:53:... • wannacry.exe
                                                              2872 TCP Disconnect DESKTOP-98I24CQ:58705 -> 169.254.129.7:microsoft-ds
 1:53:... wannacry.exe
                                                              2872 AThread Exit
                                                              2872 TCP Reconnect DESKTOP-98I24CQ:58706 -> 169.254.130.7:microsoft-ds 2872 TCP Disconnect DESKTOP-98I24CQ:58706 -> 169.254.130.7:microsoft-ds
1:53:... I wannacry.exe
1:53:... • wannacry.exe
1:53:... Is wannacry.exe
                                                              2872 CThread Exit
1:53:... wannacrv.exe
                                                              2872 TCP Reconnect DESKTOP-98I24CQ:58707 -> 169.254.131.7:microsoft-ds
1:53:... wannacry.exe
                                                              2872 TCP Disconnect DESKTOP-98I24CQ:58707 -> 169.254.131.7:microsoft-ds
                                                              2872 Thread Exit
1:53:... wannacry.exe
                                                              2872 TCP Reconnect DESKTOP-98I24CQ:58728 -> 169.254.132.7:microsoft-ds
1:53:... wannacry.exe
                                                              2872 TCP Disconnect DESKTOP-98I24CQ:58728 -> 169.254.132.7:microsoft-ds
1:53:... I wannacry.exe
                                                              2872 Thread Exit
1:53:... wannacry.exe
1:53:... I wannacry.exe
                                                              2872 CThread Create
1:53:... 📧 wannacry.exe
                                                              2872 CThread Create
1:53:... wannacry.exe
                                                              2872 TCP Disconnect DESKTOP-98/24CQ:58819 -> 169.254.133.7:microsoft-ds
```

after creating service it will go on and replace the original tasksche.exe binary with it's own malicious executable



and then create a new process with newly dropped executable

```
push eax
rep movsb
lea ecx,dword ptr ss:[esp+28]
lea edx,dword ptr ss:[esp+6C]
push ecx
push ebx
of mov dword ptr ss:[esp+4C],44
mov word ptr ss:[esp+7C],bx
of mov dword ptr ss:[esp+7C],bx
of mov dword ptr ss:[esp+7S],81

call dword ptr ds:[<&CreateProcessA>]
test eax,eax
je wannacry.407F08
mov eax,dword ptr ss:[esp+18]
push eax
call dword ptr ds:[<&ClassWandles]
```

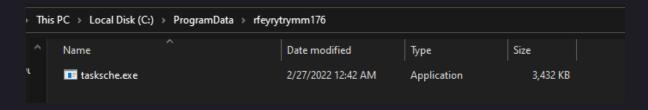
The newly created process will first generate a random string by getting the hostname of the local machine and then multiplying their ascii value to get seed for random function

```
eax : ; LPWSTR lpBuffer dword [GetComputerNamew] ; 0x4080d0 ; Gets the hostname of the local machine esi, dword [wslen] ; 0x408138 dword [var_4h], 0
         push
lea
                eax, eax
                eax, eax
ecx
0x4012a0
edi, [lpBuffer]
eax, word [edi]
ebx, eax ; get
dword [var_4h]
eax, [lpBuffer]
edi
                 dword [var_4h], eax
                 ebx ; int seed
dword [srand] ; 0x408124 ; generates random value ; void srand(int seed)
ebx, dword [rand] ; 0x408120
0x004012be
                                          0x4012d6
0x004012c0
                           call
0x004012c2
0x004012c4
0x004012c5
0x004012c6
                                          eax, dword [arg_8h]
0x004012c8
                            mov
0x004012cb
0x004012ce
                                          byte [edi + eax], dl
                            mov
0x004012d1
0x004012d2
                                          edi, esi
0x004012d4
                                          0x4012c0
                                          esi, 3
edi, esi
0x004012d6
                                                              ; Generates a string "rfeyrytrymm176"
0x004012d9
                                          0x4012f1
0x004012db
```

the random function will generate the string and then will create a new directory with that name inside C:\ProgramData directory. It will also create a registry key as below

```
0x00401b02
         0x00401b07
                                   dword [format]
         0x00401b09
         0x00401b0c
                                   edi, dword [SetCurrentDirectoryW] ; 0x408058 ; C:\ProgramData
         0x00401b12
         0x00401b14
                                   0x401b27
         0x00401b18
                                   ebx, dword [arg_ch]
         0x00401b1b
         0x00401b1d
                                  ebx
         0x00401b1e
         0x00401b20
         0x00401b21
         0x00401b25
    → 0x00401b27
             -----
       rfeyrytrymm176
                                                        2/27/2022 1:25 AM
                                                                                      File folder
                                                        11/14/2021 8:28 PM
       shimaen
                                                                                      File folder
📫 Registry Editor
File Edit View Favorites Help
Computer\HKEY_LOCAL_MACHINE\SOFTWARE\WOW6432Node\WanaCrypt0r
                                           Name
         Python
                                            ab (Default)
                                                         REG_SZ
                                                                       (value not set)
         RegisteredApplications
                                            <u>ab</u> wd
                                                         REG_SZ
                                                                       C:\ProgramData\rfeyrytrymm176
         Vim
         Windows
        WOW6432Node
           AccessData
```

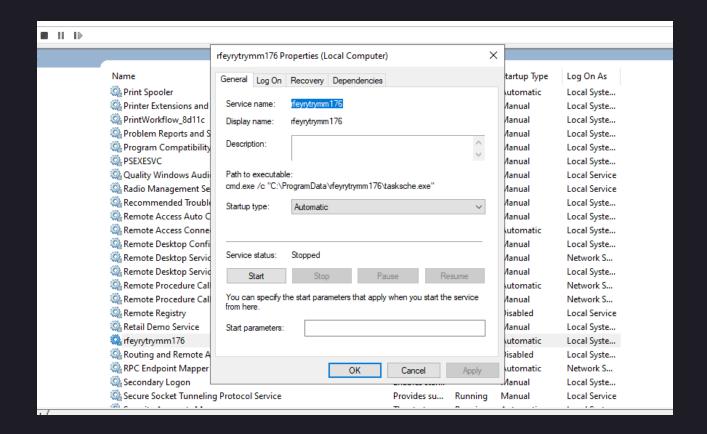
and copy itself to this new directory.



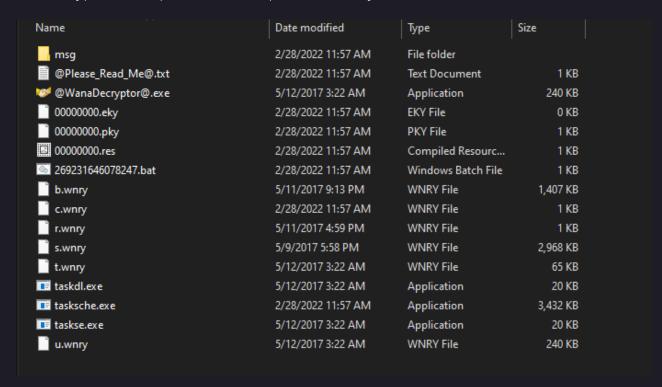
After copying itself it will create a new service

```
lea eax,dword ptr ss:[ebp-40C]
push edi
push ex
push 1
push 2
push 10
push ebx
push esi
push esi
push esi
push dword ptr ss:[ebp-4]
call dword ptr ds:[<&CreateServiceA>]
mov esi,eax
cmp esi,edi
push esi
push esi
push dword ptr ds:[<&CreateServiceA>]
mov esi,eax
cmp esi,edi
push esi
push esi
push dword ptr ds:[<&CreateServiceA>]
mov esi,eax
cmp esi,edi
push esi
push esi:"rfeyrytrymm176", eax:"cmd.exe /c \"C:\\ProgramD
esi:"rfeyrytrymm176"
```

with following binary path



Now the activated service will drop new files from the resource section. The resource section contains a zip file which contains the dropped file. Some files like 00000000.eky, 00000000.pky contains cryptographic keys which will be used for the encryption. The password for zip file is "WNcry@2ol7"



After extracting all the resource it will begin the encryption process by finding all the important files in the victim machine and encrypt them.

Below are some import functions from taskdll.exe which will be use to find files in the victim machine

OFTs	FTs (IAT)	Hint	Name
Dword	Dword	Word	szAnsi
00002204	00002204	01D6	GetTempPathW
00002214	00002214	01F4	GetWindowsDirectoryW
0000222C	0000222C	0084	DeleteFileW
0000223A	0000223A	00CE	FindClose
00002246	00002246	00DD	FindNextFileW
00002256	00002256	00D5	FindFirstFileW
00002268	00002268	0356	Sleep
00002270	00002270	0154	GetDriveTypeW
00002280	00002280	0178	GetLogicalDrives
00002654	00002654	017F	GetModuleHandleA
00002668	00002668	01B7	GetStartupInfoA

in the end after all the encryption process is done the victim desktop will look like below image.



Indicators of Compromise

1st March 2022

Network Indicators

1. Making request to www[.]iuqerfsodp9ifjaposdfjhgosurijfaewrwergwea[.]com

```
> Frame 5: 109 bytes on wire (872 bits), 109 bytes captured (872 bits) on interface enp0s3, id 0
> Ethernet II, Src: PcsCompu_09:ea:4b (08:00:27:09:ea:4b), Dst: PcsCompu_b8:16:a4 (08:00:27:b8:16:a4)
> User Datagram Protocol, Src Port: 59998, Dst Port: 53

> Domain Name System (query)
    Transaction ID: 0x5717
> Flags: 0x0100 Standard query
    Questions: 1
    Answer RRs: 0
    Authority RRs: 0
    Additional RRs: 0
    Queries
    > www.iuqerfsodp9ifjaposdfjhgosurijfaewrwergwea.com: type A, class IN

| December 11: 54 bytes on wire (1232 bits), 154 bytes captured (1232 bits) on interface enp0s3, id 0
| Ethernet II, Src: PcsCompu_09:ea:4b (08:00:27:09:ea:4b), Dst: PcsCompu_b8:16:a4 (08:00:27:b8:16:a4)
> Internet Protocol Version 4, Src: 192.168.56.3, Dst: 192.168.56.4

> Transmission Control Protocol, Src Port: 49678, Dst Port: 80, Seq: 1, Ack: 1, Len: 100

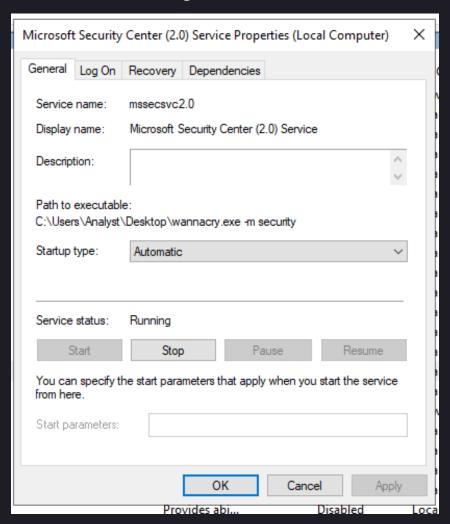
+ Hypertext Transfer Protocol
    GET / HTTP/1.1\r\n
Host: www.iuqerfsodp9ifjaposdfjhgosurijfaewrwergwea.com\r\n
    Cache-Control: no-cache\r\n
    \r\n
    \r\n
    [Full request URI: http://www.iuqerfsodp9ifjaposdfjhgosurijfaewrwergwea.com/]
    [HTTP request 1/1]
    [Response in frame: 14]
```

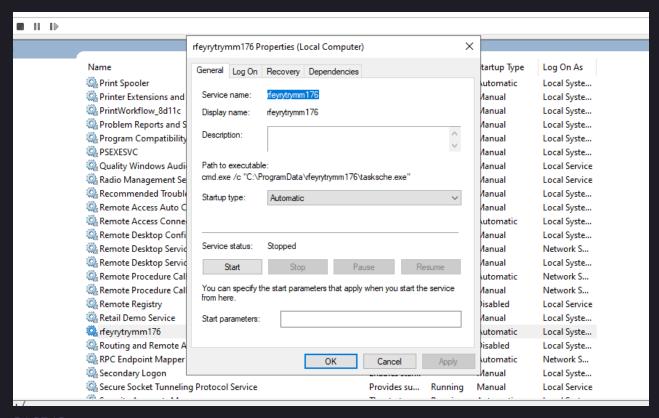
Host Indicators

• Presence of following files "qeriuwjhrf" and "tasksche.exe".

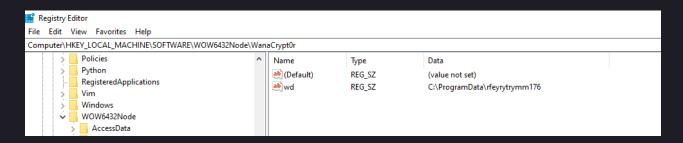
ıvame	Date modified	iype ActiveX control	Size
msscript.ocx	4/14/2008 5:40 AM		108 KB '
notepad.exe	3/18/2019 9:45 PM	Application	177 KB
PFRO.log	2/20/2022 3:23 PM	Text Document	8 KB
Professional.xml	3/18/2019 9:46 PM	XML Document	35 KB
ProfessionalEducation.xml	3/18/2019 9:46 PM	XML Document	35 KB
ProfessionalWorkstation.xml	3/18/2019 9:46 PM	XML Document	35 KB
■ PSEXESVC.exe	1/23/2022 11:29 PM	Application	375 KB
📒 py.exe	8/17/2020 7:02 PM	Application	884 KB
pyshellext.amd64.dll	8/17/2020 7:04 PM	Application exten	57 KB
膈 pyw.exe	8/17/2020 7:02 PM	Application	885 KB
qeriuwjhrf	3/18/2019 9:45 PM	File	177 KB
📑 regedit.exe	3/18/2019 9:45 PM	Application	350 KB
irichtx32.ocx	3/12/2001 4:07 PM	ActiveX control	254 KB
🚍 splwow64.exe	10/6/2019 7:56 PM	Application	129 KB
📓 system.ini	3/18/2019 9:49 PM	Configuration sett	1 KB
tasksche.exe	3/1/2022 11:01 AM	Application	3,432 KB
₫ twain_32.dll	3/18/2019 9:46 PM	Application exten	63 KB
📓 win.ini	3/18/2019 9:49 PM	Configuration sett	1 KB
WindowsShell.Manifest	3/18/2019 9:44 PM	MANIFEST File	1 KB
WindowsUpdate.log	3/1/2022 11:00 AM	Text Document	1 KB
💈 winhlp32.exe	3/18/2019 9:46 PM	Application	12 KB
WMSysPr9.prx	3/18/2019 11:23 PM	PRX File	310 KB
📝 write.exe	3/18/2019 9:45 PM	Application	11 KB

• Presence of following services

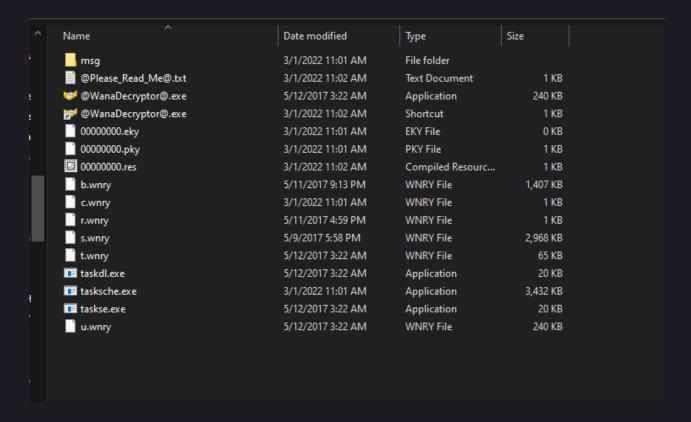




Presence of following Registry Key



• Presence of following files the directory saved in the registry key shown above



Yara Rule and Signature

1st March 2022

Full Yara rules can be found in the following github link https://github.com/0xZuk0/rules-of-yaras/blob/main/wannacry.yara

```
rule WannaCry
       last_updated = "01-03-2022"
       author = "Zuk0"
       description = "Yara rule to detect wannacry ransomware"
       $killswitch_domain = "www.iuqerfsodp9ifjaposdfjhgosurijfaewrwergwea.com" ascii
       $string1 = "C:\\%s\\qeriuwjhrf" ascii
       $reg_name = "WanaCrypt0r" wide
       $password = "WNcry@2o17" ascii
        $service_name = "Microsoft Security Center (2.0) Service" ascii
       pe.is_pe and
       hash.sha256(0, filesize) == "24d004a104d4d54034dbcffc2a4b19a11f39008a575aa614ea04703480b1022c" and
       hash.sha256(204964, 3514368) == "ed01ebfbc9eb5bbea545af4d01bf5f1071661840480439c6e5babe8e080e41aa" and
       $string1 and
       $reg_name and
       $exe1 and
        Sexe2 and
```