



LokiBot

Technical Analysis Report

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LokiBot and What You Need to Know

What is LokiBot?

LokiBot, also known as Loki PWS or Loki-bot, is a Trojan malware designed for the illicit purpose of stealing sensitive information such as usernames, passwords, cryptocurrency wallets, and other identity-related data. The LokiBot Trojan malware made its initial appearance in 2015 and has since gained significant notoriety among cybercriminal circles as an effective means of establishing a backdoor into compromised Windows systems. This malicious software continues to thrive due to its proficiency in surreptitiously exfiltrating valuable information.

Functioning as a malicious software family, LokiBot monitors both browser and desktop activities, systematically pilfering critical data from victims, including user credentials, bank particulars, and the contents of cryptocurrency wallets. The defining characteristic of LokiBot lies in its ability to capture and record sensitive data, a behavior commonly observed in Trojan horse viruses. It methodically gathers stored login credentials and passwords, primarily within web browsers, and maintains constant surveillance over user activities, such as keystroke logging.

The acquired information is promptly relayed to a remote server under the control of LokiBot's developers. This streamlined transfer of data ensures that captured details are swiftly at the disposal of malicious actors. Notably, malicious cyber agents frequently deploy LokiBot to target systems running Windows and Android operating systems. They propagate this malevolent software through various means, including but not limited to email, phishing websites, text messages, and other personalized communication channels.

In essence, LokiBot epitomizes the art of infiltrating systems with the primary goal of extracting sensitive data. Its intricate techniques and operational methods underline the ongoing challenge posed by such advanced forms of cyber threats, necessitating a comprehensive and multi-faceted approach to cybersecurity.

LokiBot Overview

Kellyzx.exe, a malicious software, has been identified as carrying out a series of harmful actions for malicious purposes. Upon closer examination, it has been determined that the malware engages in loading DLL files to execute harmful processes. Additionally, it establishes persistence within the system by dropping an executable file named "**hxnj.exe**" and making changes to the Windows Registry. This enables the malware to maintain a foothold within the compromised system, ensuring its presence even after system reboots.

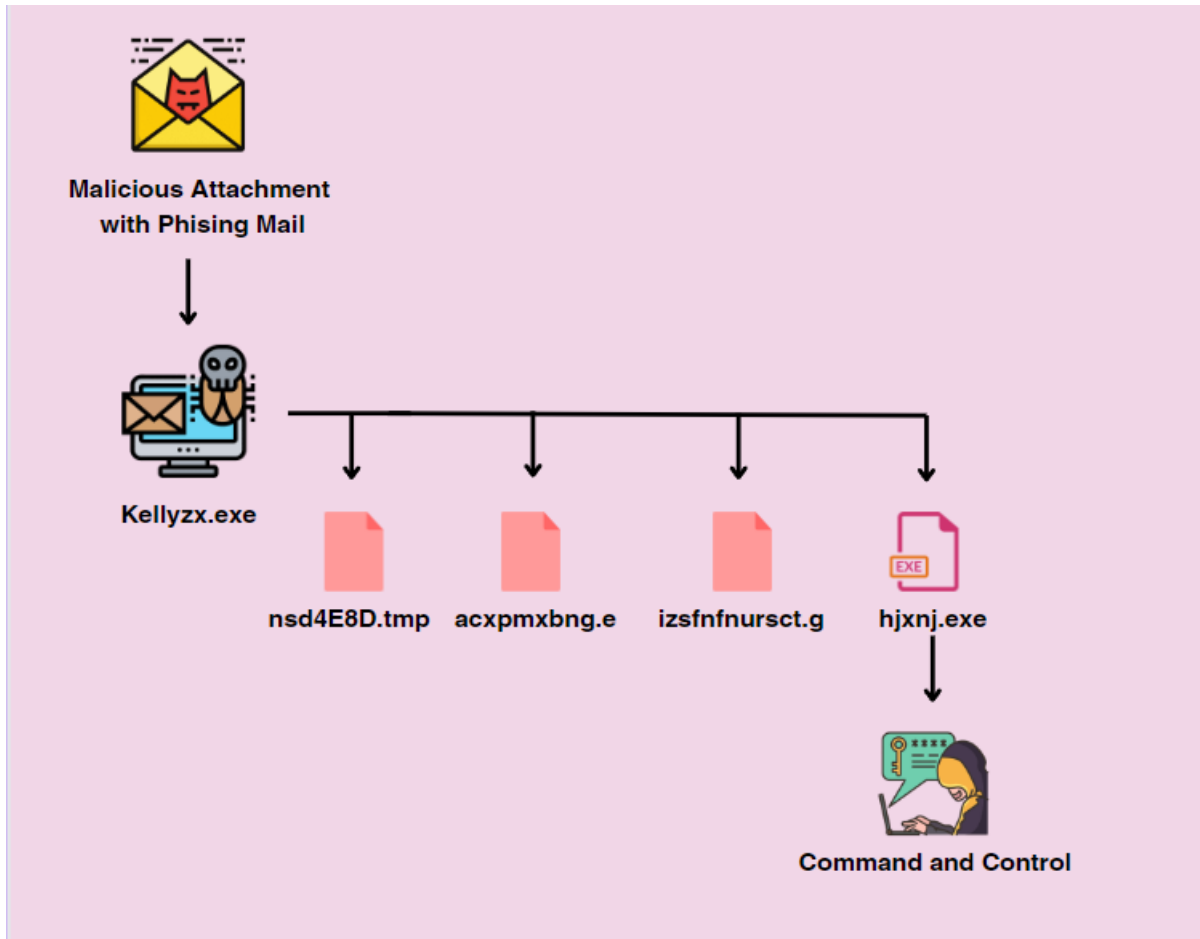
The malware's modus operandi unfolds as follows: After establishing a connection with the IP address "**171[.]22[.]30[.]147**" via TCP, the malware initiates communication with a remote command and control server. This connection serves as a conduit for the malware operators to exert control and issue instructions to the compromised system.

Subsequently, the malware undertakes data collection, which it accomplishes through a POST request to the URL "**/kelly/five/fre[.]php http/1.0 POST**." Through this request, the malware encrypts the harvested sensitive data, thereby concealing its contents from potential interception during transmission. The encrypted data is then sent to the command and control server, enabling the malicious actors to access and exploit the stolen information.

Upon the successful transfer of data, the TCP connection is terminated. This step further obfuscates the malicious activity, complicating efforts to track and mitigate the threat.

In conclusion, **Kellyzx.exe** malicious software employs a multi-step process to infiltrate systems, establish persistence, communicate with a remote server, encrypt stolen data, and evade detection. Countering such threats requires robust cybersecurity measures, including up-to-date security solutions, patch management, and user education to thwart potential attacks and mitigate their impact.

Infection Chain



Static Analysis

Kellyzx.exe Analysis

File Name	kellyzx.exe
SHA-1	E6107CA70A7E8461A0105FAE3F8FE6DE9A65FF17
MD5	3BC68A0764CCC400C9A9F595E9F3ED3E
File Type	PE32/EXE

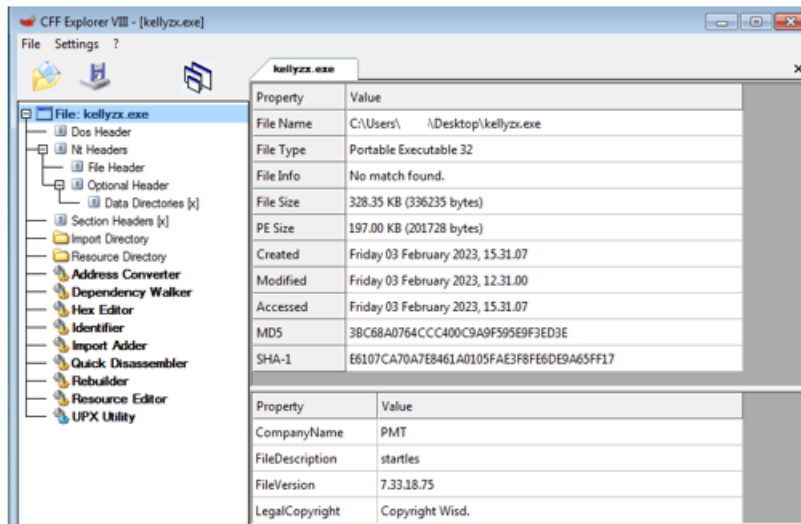


Figure 1- Information about file

gozcu64.exe	15.81	12.796 K	25.428 K	2464	Sysinternals Process Explorer	Sysinternals - www.sysinter...
kellyzx.exe	4.80	10.060 K	7.360 K	3372		
hxnj.exe	0.74	976 K	3.808 K	3376		

Figure 2- Process monitor logs of kellyzx.exe

Close examination of the malware reveals that it creates a child process by launching the executable "hxnj.exe".

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kellyzx.exe	3288	CreateFile	C:\Users\	\AppData\Local\Temp\acxprmbng.e
kellyzx.exe	3288	QueryBasicInfor...	C:\Users\	\AppData\Local\Temp\acxprmbng.e
kellyzx.exe	3288	CloseFile	C:\Users\	\AppData\Local\Temp\acxprmbng.e
kellyzx.exe	3288	CreateFile	C:\Users\	\AppData\Local\Temp\acxprmbng.e
kellyzx.exe	3288	CreateFile	C:\Users\	\AppData\Local\Temp\izsfnfursct.g
kellyzx.exe	3288	QueryBasicInfor...	C:\Users\	\AppData\Local\Temp\izsfnfursct.g
kellyzx.exe	3288	CloseFile	C:\Users\	\AppData\Local\Temp\izsfnfursct.g
kellyzx.exe	3288	CreateFile	C:\Users\	\AppData\Local\Temp\izsfnfursct.g
kellyzx.exe	3288	CreateFile	C:\Users\	\AppData\Local\Temp\hxnj.exe
kellyzx.exe	3288	QueryBasicInfor...	C:\Users\	\AppData\Local\Temp\hxnj.exe
kellyzx.exe	3288	CreateFile	C:\Users\	\AppData\Local\Temp\nsb37F3.tmp
kellyzx.exe	3288	CloseFile	C:\Users\	\AppData\Local\Temp\nsb37F3.tmp
kellyzx.exe	3288	CreateFile	C:\Users\	\AppData\Local\Temp\nsb37F3.tmp
kellyzx.exe	3288	QueryDirectory	C:\Users\	\AppData\Local\Temp\nsb37F3.tmp
kellyzx.exe	3288	CloseFile	C:\Users\	\AppData\Local\Temp\nsb37F3.tmp
kellyzx.exe	3288	CreateFile	C:\Users\	\AppData\Local\Temp\nsb37F3.tmp

Figure 3- Logs

Upon scrutinizing the log records of the target system, it becomes evident that the malicious file employs the **CreateFile API** to generate files with diverse extensions and randomly assigned names.

Dynamic Analysis

```

004069D4 8D85 C4DFDFFF lea eax,dword ptr ss:[ebp-23C]
004069DA 56 push esi
004069DB 50 push eax
004069DC FF15 80804000 call dword ptr ds:[<&GetSystemDirectoryW>]
004069E2 38C6 cmp eax,esi
004069E4 5E pop esi
004069E5 76 02 jbe kellyzx.4069E9
004069E7 33C0 xor eax,eax
004069E9 85C0 test eax,eax
004069EB 74 0F je kellyzx.4069FC
004069ED 66:83BC45 C2FDFFFF 5C cmp word ptr ss:[ebp+eax*2-23E],5C
004069FE 74 04 je kellyzx.4069FC
004069FB 33C9 xor ecx,ecx
004069FA EB 03 jmp kellyzx.4069FF
004069FC 33C9 xor ecx,ecx
004069FE 41 inc ecx
004069FF FF75 08 push dword ptr ss:[ebp+8]
00406A02 8D0C4D 14A04000 lea ecx,dword ptr ds:[ecx*2+40A014]
00406A09 8D8445 C4DFDFFF lea eax,dword ptr ss:[ebp+eax*2-23C]
00406A10 51 push ecx
00406A11 68 E0A54000 push kellyzx.40A5E0
00406A16 50 push eax
00406A17 FF15 54824000 call dword ptr ds:[<&wsprintfw>]
00406A1D 83C4 10 add esp,10
00406A20 8D85 C4DFDFFF lea eax,dword ptr ss:[ebp-23C]
00406A26 6A 08 push 8
00406A28 6A 00 push 0
00406A2A 50 push eax
00406A2B FF15 40814000 call dword ptr ds:[<&LoadLibraryExW>]
00406A31 C9 leave
00406A32 C2 0400 ret 4
00406A35 8B4424 04 mov eax,dword ptr ss:[esp+4]
00406A39 56 push esi
00406A3A 8BF0 mov esi,eax
00406A3C 57 push edi

```

exe: \$6A2B #5E2B

```

00 00 00 08 00 00 00 43 00 3A 00 @u.....C.:
00 0E 00 64 00 6F 00 77 00 73 00 \.w.i.n.d.o.w.s
00 73 00 74 00 65 00 6D 00 33 00 \.s.y.s.t.e.m.3.
00 52 00 59 00 50 00 54 00 42 00 2.\C.R.Y.P.T.B.
00 2E 00 64 00 6C 00 6C 00 00 00 A.S.E...d.l...

```

Figure 4- Loads DLL

With the **LoadLibraryExW API**, it loads DLLs to change system settings, access sensitive data or take control of the system, execute malicious drivers or disable security features, and download additional malicious data.

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C:\\Windows\\system32\\CLBCATQ.dll	C:\\Windows\\system32\\APPHELP.dll
C:\\Windows\\system32\\NTMARTA.dll	C:\\Windows\\system32\\DWMAPI.dll
C:\\Windows\\system32\\UXTHEME.dll	C:\\Windows\\system32\\OLEACC.dll
C:\\Windows\\system32\\USERENV.dll	C:\\Windows\\system32\\CLBCATQ.dll
C:\\Windows\\system32\\SETUPAPI.dll	C:\\Windows\\system32\\SHFOLDER.dll
C:\\Windows\\system32\\NTMARTA.dll	C:\\Windows\\system32\\CRYPTBASE.dll

Table 1- Files with .dll extension loaded by malicious file

```

kellyzx.00406107
mov eax,esi ; eax:L"C:\\Users\\[redacted]\\AppData\\Local\\Temp\\nsv278c.tmp", esi:L"C:\\Users\\[redacted]\\AppData\\Local\\Temp\\"
jmp kellyzx.406108

kellyzx.00406194
mov eax,dword ptr ds:[40A5A8] ; eax:L"C:\\Users\\[redacted]\\AppData\\Local\\Temp\\nsv278c.tmp", 0040A5A8:L"nsa"
dec edi
mov dword ptr ss:[ebp-8],eax
mov eax,dword ptr ds:[40A5A8] ; eax:L"C:\\Users\\[redacted]\\AppData\\Local\\Temp\\nsv278c.tmp"

```

Figure 5- Getting the name of the .tmp file

The name of the file "nsd4E8D.tmp" is generated in the directory "C:\\Users\\Admin\\AppData\\Local\\Temp". The malicious software creates the name for the .tmp extension file with the prefix "ns" followed by random characters, as observed. This is often done to obfuscate the file and its purpose, making it harder for security measures to detect it. Using random names and prefixes adds an extra layer of camouflage to the malicious file, increasing its chances of going unnoticed within the system.

```

kellyzx.0040328B
call dword ptr ds:[<&GlobalAlloc>]
mov ecx,kellyzx.40CE68
mov esi,eax ; eax:L"C:\\Users\\[redacted]\\AppData\\Local\\Temp\\nsz36c.tmp"
call kellyzx.406890
lea eax,dword ptr ss:[ebp-22c]
push kellyzx.437800 ; 437800:L"C:\\Users\\[redacted]\\AppData\\Local\\Temp\\"
push eax ; eax:L"C:\\Users\\[redacted]\\AppData\\Local\\Temp\\nsz36c.tmp"
call kellyzx.406187
push ebx
push 4000100
push 2
push ebx
push ebx
lea eax,dword ptr ss:[ebp-22c]
push C0000000
push eax ; eax:L"C:\\Users\\[redacted]\\AppData\\Local\\Temp\\nsz36c.tmp"
call dword ptr ds:[<&CreateFilew>]
cmp eax,FFFFFFFF ; eax:L"C:\\Users\\[redacted]\\AppData\\Local\\Temp\\nsz36c.tmp"
mov dword ptr ds:[40A01C],eax ; eax:L"C:\\Users\\[redacted]\\AppData\\Local\\Temp\\nsz36c.tmp"
jne kellyzx.4032E8

```

Figure 6- Creating the .tmp file

The file created with the GlobalAlloc API is allocated in the "C:\\Users\\Admin\\AppData\\Local\\Temp" directory. After this space, the "nsd4E8D.tmp" file with the .tmp extension is created using the CreateFile API. This temporary file is created to store data or execute certain actions as part of the malware's operations.

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```
kellyzx.00406158
push dword ptr ss:[esp+4] ; [esp+4]:L"C:\\Users\\[redacted]\\AppData\\Local\\Temp\\acxpmxbng.e"
call dword ptr ds:[<&GetFileAttributesw>]
mov ecx,eax
push 0
inc ecx
neg ecx
sbb ecx,ecx
and ecx,eax
push ecx
push dword ptr ss:[esp+14]
push 0
push 1
push dword ptr ss:[esp+1C]
push dword ptr ss:[esp+1C]
call dword ptr ds:[<&CreateFilew>]
ret c
```

Figure 7- Creation of acxpmxbng.e file

```
ret 4
push dword ptr ss:[esp+4]
call dword ptr ds:[<&GetFileAttributesw>]
mov ecx,eax
push 0
inc ecx
neg ecx
sbb ecx,ecx
and ecx,eax
push ecx
push dword ptr ss:[esp+14]
push 0
push 1
push dword ptr ss:[esp+1C]
push dword ptr ss:[esp+1C]
call dword ptr ds:[<&CreateFilew>]
[esp+4]:L"C:\\Users\\[redacted]\\AppData\\Local\\Temp\\izsfnfurct.g"
```

Figure 8- Creating the izsfnfurct.g file

As shown in Figures 7 and 8, files with arbitrary names and **.e** and **.g** extensions are created in the "C:\Users\Admin\AppData\Local\Temp" directory. The malicious file implements an evasion technique by interfering with legitimate files commonly found in temporary directories. By using arbitrary names and extensions, malware aims to avoid detection by security solutions that rely on specific file naming conventions or extensions to identify potentially malicious files. This technique adds to the malware's ability to stay undetected and works secretly within the system.

```
00406152 88C6 mov eax,es1
00406154 5E pop es1
00406155 C2 0400 ret 4
00406158 FF7424 04 push dword ptr ss:[esp+4]
0040615C FF15 04814000 call dword ptr ds:[<&GetFileAttributesw>]
00406162 88C8 mov ecx,eax
00406164 6A 00 push 0
00406166 41 inc ecx
00406167 F709 neg ecx
00406169 18C9 sbb ecx,ecx
0040616B 23C8 and ecx,eax
0040616D 51 push ecx
0040616E FF7424 14 push dword ptr ss:[esp+14]
00406172 6A 00 push 0
00406174 6A 01 push 1
00406176 FF7424 1C push dword ptr ss:[esp+1C]
0040617A FF7424 1C push dword ptr ss:[esp+1C]
0040617E FF15 F4804000 call dword ptr ds:[<&CreateFilew>]
00406184 C2 0C00 ret c
es1:&L"SGP"
es1:&L"SGP"
[esp+4]:L"C:\\Users\\[redacted]\\AppData\\Local\\Temp\\hjxnj.exe"
```

Figure 9- Creating the file named hjxnj.exe

An executable file named "hjnx.exe" is created in the "C:\Users\Admin\AppData\Local\Temp" directory. This action is executed as a part of the malware's propagation strategy. By generating an executable file within the temporary directory, the malware seeks to establish a foothold on the compromised system and execute its malicious code. The use of the temporary directory aids in concealing the file amidst a myriad of other temporary files, making it harder for users or security solutions to immediately discern its presence.

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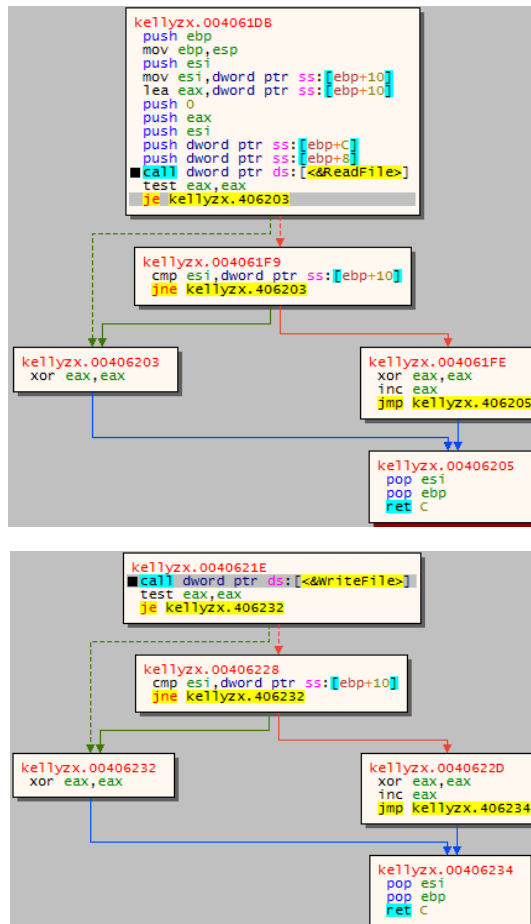


Figure 10- Use of ReadFile and WriteFile APIs

For all files created on the target system, file reading and writing operations are performed using the **ReadFile** and **WriteFile** APIs.

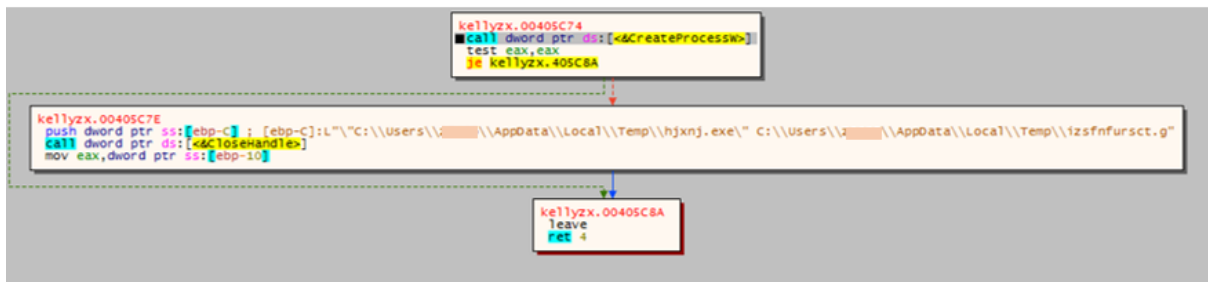


Figure 11- Usage of CreateProcess API

The file named **hxnj.exe** created by the malware is started as a process on the target system using the **CreateProcess** API.

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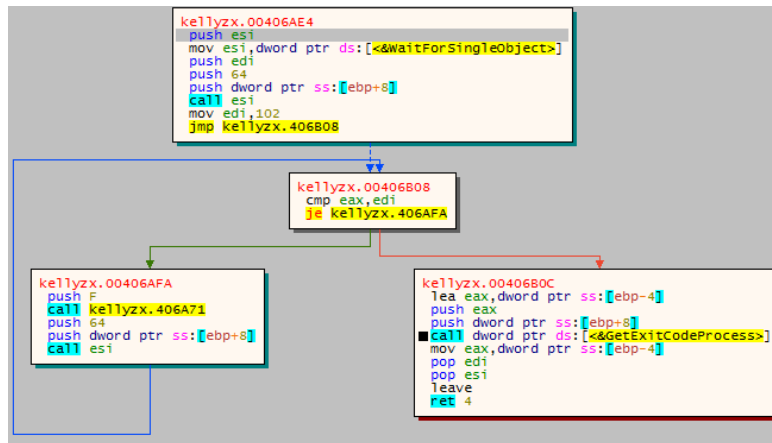


Figure 12- Closing the malicious file

As seen in Figure 12, it gets the termination status of the **kellyzx.exe** process running using the **GetExitCodeProcess** API.

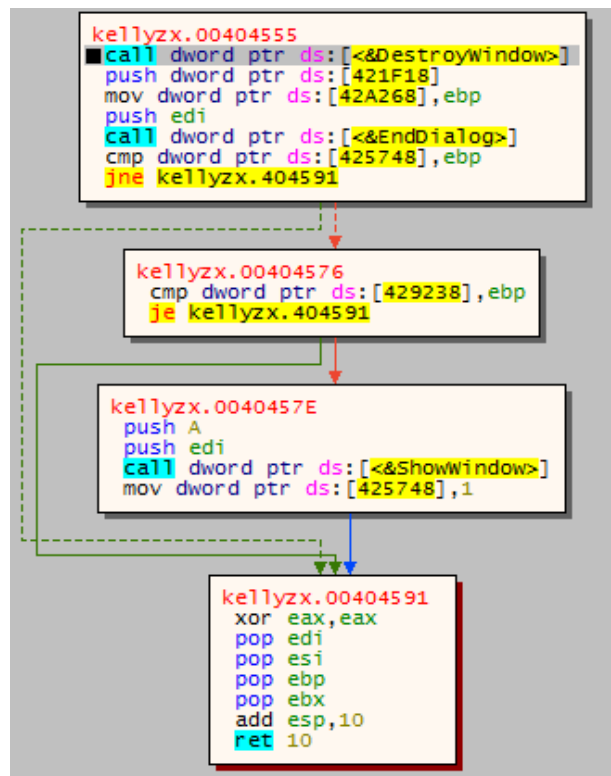


Figure 13- Termination of the kellyzx.exe

The malware first closes the current window with the **DestroyWindow** API. It then closes the dialog with the **EndDialog** API.

The malware continues with the **hjxnj.exe** it created to other processes on the target device.

hjxnj.exe Analysis

File Name	hjxnj.exe
SHA-1	EC95F0F1DC55A51903696E021963EEACC210FF05
MD5	CF86B09B00E89238F9205E6D469BCDD6
File Type	PE32/EXE

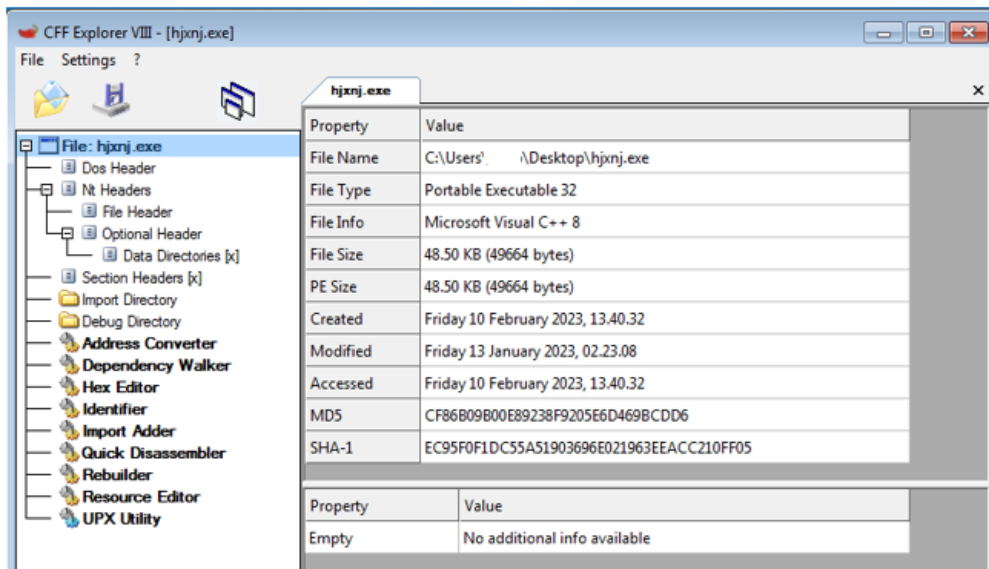


Figure 14- Examination of the Pest in CFF Explorer

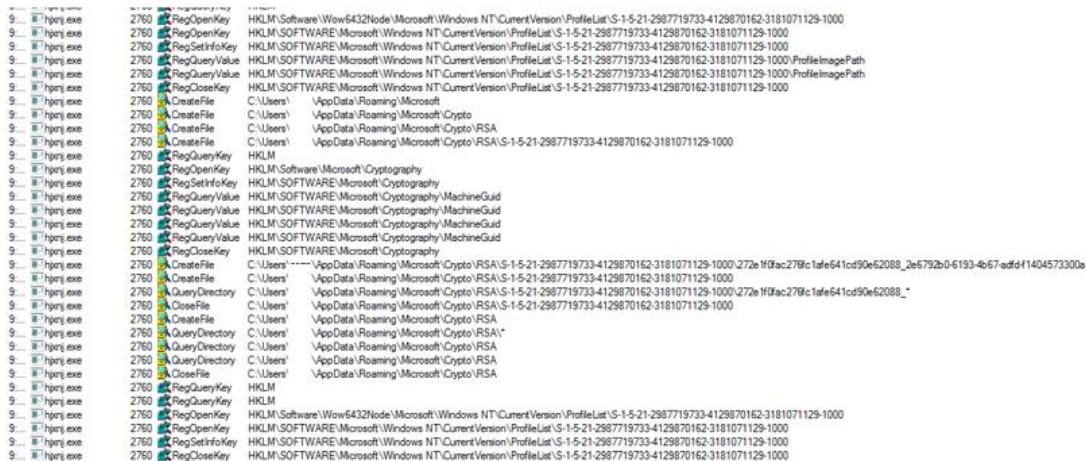


Figure 15- Examination of log records

The log records of the file named **hjxnj** on the target device after the malware starts running are shown in Figure 15.

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hpxnj.exe	2760	CreateFile	C:\Users\	\AppData\Roaming\Microsoft\Crypto\RSA\S-1-5-21-2987719733-4129870162-3181071129-1000\272e1f0fac276fc1afe641cd90e62088_2e6792b0-6193-4b67-adfd-f1404573300a
hpxnj.exe	2760	QueryStandardI...	C:\Users\	\AppData\Roaming\Microsoft\Crypto\RSA\S-1-5-21-2987719733-4129870162-3181071129-1000\272e1f0fac276fc1afe641cd90e62088_2e6792b0-6193-4b67-adfd-f1404573300a
hpxnj.exe	2760	WriteFile	C:\Users\	\AppData\Roaming\Microsoft\Crypto\RSA\S-1-5-21-2987719733-4129870162-3181071129-1000\272e1f0fac276fc1afe641cd90e62088_2e6792b0-6193-4b67-adfd-f1404573300a
hpxnj.exe	2760	CloseFile	C:\Users\	\AppData\Roaming\Microsoft\Crypto\RSA\S-1-5-21-2987719733-4129870162-3181071129-1000\272e1f0fac276fc1afe641cd90e62088_2e6792b0-6193-4b67-adfd-f1404573300a
hpxnj.exe	2760	CreateFile	C:\Users\	\AppData\Roaming\Microsoft\Crypto\RSA\S-1-5-21-2987719733-4129870162-3181071129-1000\272e1f0fac276fc1afe641cd90e62088_2e6792b0-6193-4b67-adfd-f1404573300a
hpxnj.exe	2760	QueryAttribute T...	C:\Users\	\AppData\Roaming\Microsoft\Crypto\RSA\S-1-5-21-2987719733-4129870162-3181071129-1000\272e1f0fac276fc1afe641cd90e62088_2e6792b0-6193-4b67-adfd-f1404573300a
hpxnj.exe	2760	SetDispositionI...	C:\Users\	\AppData\Roaming\Microsoft\Crypto\RSA\S-1-5-21-2987719733-4129870162-3181071129-1000\272e1f0fac276fc1afe641cd90e62088_2e6792b0-6193-4b67-adfd-f1404573300a
hpxnj.exe	2760	CloseFile	C:\Users\	\AppData\Roaming\Microsoft\Crypto\RSA\S-1-5-21-2987719733-4129870162-3181071129-1000\272e1f0fac276fc1afe641cd90e62088_2e6792b0-6193-4b67-adfd-f1404573300a
hpxnj.exe	2760	ReadFile	C:\	\AppData\Roaming\Microsoft\Crypto\RSA\S-1-5-21-2987719733-4129870162-3181071129-1000\272e1f0fac276fc1afe641cd90e62088_2e6792b0-6193-4b67-adfd-f1404573300a
hpxnj.exe	2760	CreateFile	C:\Users\	\AppData\Roaming\Microsoft\Crypto\RSA\S-1-5-21-2987719733-4129870162-3181071129-1000\272e1f0fac276fc1afe641cd90e62088_2e6792b0-6193-4b67-adfd-f1404573300a
hpxnj.exe	2760	QueryDirectory	C:\Users\	\AppData\Roaming\Microsoft\Crypto\RSA\S-1-5-21-2987719733-4129870162-3181071129-1000\272e1f0fac276fc1afe641cd90e62088_2e6792b0-6193-4b67-adfd-f1404573300a
hpxnj.exe	2760	CloseFile	C:\Users\	\AppData\Roaming\Microsoft\Crypto\RSA\S-1-5-21-2987719733-4129870162-3181071129-1000\272e1f0fac276fc1afe641cd90e62088_2e6792b0-6193-4b67-adfd-f1404573300a
hpxnj.exe	2760	CreateFile	C:\Users\	\AppData\Roaming\Microsoft\Crypto\RSA\S-1-5-21-2987719733-4129870162-3181071129-1000\272e1f0fac276fc1afe641cd90e62088_2e6792b0-6193-4b67-adfd-f1404573300a
hpxnj.exe	2760	QueryDirectory	C:\Users\	\AppData\Roaming\Microsoft\Crypto\RSA\S-1-5-21-2987719733-4129870162-3181071129-1000\272e1f0fac276fc1afe641cd90e62088_2e6792b0-6193-4b67-adfd-f1404573300a
hpxnj.exe	2760	QueryDirectory	C:\Users\	\AppData\Roaming\Microsoft\Crypto\RSA\S-1-5-21-2987719733-4129870162-3181071129-1000\272e1f0fac276fc1afe641cd90e62088_2e6792b0-6193-4b67-adfd-f1404573300a
hpxnj.exe	2760	CloseFile	C:\Users\	\AppData\Roaming\Microsoft\Crypto\RSA\S-1-5-21-2987719733-4129870162-3181071129-1000\272e1f0fac276fc1afe641cd90e62088_2e6792b0-6193-4b67-adfd-f1404573300a

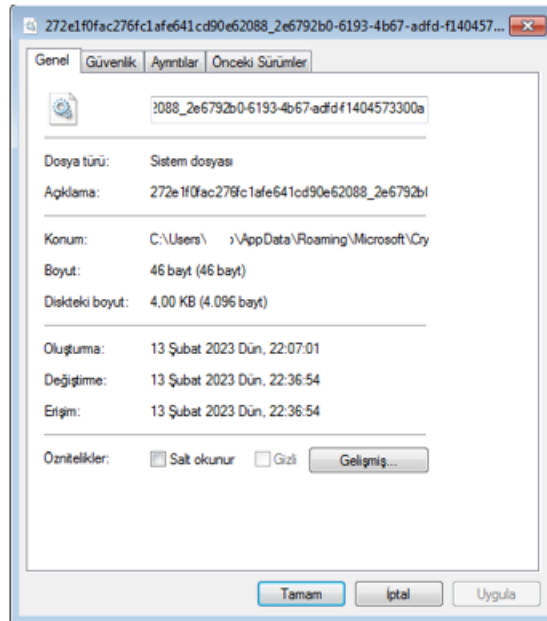


Figure 16- Changes made by the malware in the RSA folder

It modifies certificates stored in the system file named "272e1f0fac276fc1afe641cd90e62088_2e6792b0-6193-4b67-adfd-f1404573300a," found in the directory "C:\Users\Admin\AppData\Roaming\Microsoft\Crypto\RSA\S-1-5-21-2987719733-4129870162-3181071129-1000" By leveraging the WriteFile API, it alters the contents of the file, manipulating the certificates and impersonating the user identity to gain access to sensitive data. Through this process, the malicious actor seeks to exploit vulnerabilities, potentially compromising confidential information.

hpxnj.exe	2760	CreateFile	C:\Users\	\AppData\Roaming\33DCE1\1F197C.exe
hpxnj.exe	2760	SetBasicInform...	C:\Users\	\AppData\Roaming\33DCE1\1F197C.exe
hpxnj.exe	2760	CloseFile	C:\Users\	\AppData\Roaming\33DCE1\1F197C.exe
hpxnj.exe	2760	CreateFile	C:\Users\	\AppData\Roaming\33DCE1
hpxnj.exe	2760	SetBasicInform...	C:\Users\	\AppData\Roaming\33DCE1
hpxnj.exe	2760	CloseFile	C:\Users\	\AppData\Roaming\33DCE1

Figure 17- The malware creates an executable file

It creates an executable file named 1F197C.exe in the "C:\Users\Admin\AppData\Roaming\33DCE1" directory and then closes this file.

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```
.text:00404656
.text:00404656 loc_404656:
.text:00404656 push esi
.text:00404657 lea eax, [ebp+SystemTimeAsFileTime] ; Load Effective Address
.text:0040465A push eax ; lpSystemTimeAsFileTime
.text:0040465B call ds:GetSystemTimeAsFileTime ; Indirect Call Near Procedure
.text:00404661 mov esi, [ebp+SystemTimeAsFileTime.dwHighDateTime]
.text:00404664 xor esi, [ebp+SystemTimeAsFileTime.dwLowDateTime] ; Logical Exclusive OR
.text:00404667 call ds:GetCurrentProcessId ; Indirect Call Near Procedure
.text:0040466D xor esi, eax ; Logical Exclusive OR
.text:0040466F call ds:GetCurrentThreadId ; Indirect Call Near Procedure
.text:00404675 xor esi, eax ; Logical Exclusive OR
.text:00404677 call ds:GetTickCount ; Indirect Call Near Procedure
.text:0040467D xor esi, eax ; Logical Exclusive OR
.text:0040467F lea eax, [ebp+PerformanceCount] ; Load Effective Address
.text:00404682 push eax ; lpPerformanceCount
.text:00404683 call ds:QueryPerformanceCounter ; Indirect Call Near Procedure
.text:00404689 mov eax, dword ptr [ebp+PerformanceCount+4]
.text:0040468C xor eax, dword ptr [ebp+PerformanceCount] ; Logical Exclusive OR
.text:0040468F xor esi, eax ; Logical Exclusive OR
.text:00404691 cmp esi, edi ; Compare Two Operands
.text:00404693 jnz short loc_40469C ; Jump if Not Zero (ZF=0)
```

Figure 18- Obtaining system information

The malware uses the APIs shown in Figure 18 to get the information of the system time, the current process and thread id.

<pre>mov edi,edi push edi push hjxnj.409EC4 call dword ptr ds:[<&GetModuleHandlew>] mov edi,eax test edi,edi jne hjxnj.4044C6 call hjxnj.4041F6 xor eax,eax pop edi ret push esi mov esi,dword ptr ds:[<&GetProcAddress>] push hjxnj.409F00 push edi call esi push hjxnj.409EF4 push edi mov dword ptr ds:[<&F1sAlloc>],eax call esi push hjxnj.409EE8 push edi mov dword ptr ds:[<&F1sGetValue>],eax call esi push hjxnj.409EE0 push edi mov dword ptr ds:[<&F1sSetValue>],eax call esi cmp dword ptr ds:[<&F1sAlloc>],0 mov esi,dword ptr ds:[<&F1sSetValue>] mov dword ptr ds:[<&F1sFree>],eax je hjxnj.404526 cmp dword ptr ds:[<&F1sGetValue>],0 je hjxnj.404526 cmp dword ptr ds:[<&F1sSetValue>],0 je hjxnj.404526 test eax,eax jne hjxnj.40454A mov eax,dword ptr ds:[<&F1sGetValue>] mov dword ptr ds:[<&F1sGetValue>],eax</pre>	<pre>409EC4: L"KERNEL32.DLL" 409F00: "F1sAlloc" 409EF4: "F1sGetValue" 409EE8: "F1sSetValue" 409EE0: "F1sFree"</pre>
---	---

Figure 19- APIs used by the malicious file

The malicious file analyzes in dynamic time and uses the necessary APIs.

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```

push ecx
call dword ptr ds:[<&GetEnvironmentStringsW>]
mov esi,eax
xor ecx,ecx
cmp esi,ecx
jne hjxnj.404121
xor eax,eax
pop esi
ret
cmp word ptr ds:[esi],cx
je hjxnj.404136
add eax,2
cmp word ptr ds:[eax],cx
jne hjxnj.404126
add eax,2
cmp word ptr ds:[eax],cx
jne hjxnj.404126
push ebx
sub eax,esi
lea ebx,dword ptr ds:[eax+2]
push edi
push ebx
call hjxnj.405A08
mov edi,eax
pop ecx
test edi,edi
jne hjxnj.404157
push esi
call dword ptr ds:[<&FreeEnvironmentStringsW>]
mov eax,edi
pop edi
nop ahx
    
```

Figure 20- The malware collects information

It appears that the malware obtains this information from files containing important information about the current user's profile, system configuration and environment in order to store sensitive information on the target device, insert malicious code into critical system files or perform various malicious functions.

ALLUSERSPROFILE=C:\\ProgramData	windows_tracing_logfile=C:\\BVTBin\\Tests\\installpackage\\csilogfile.log
LOCALAPPDATA=C:\\Users\\Admin\\AppData\\Local	PROCESSOR_ARCHITECTURE=x86
LOGONSERVER=\\ComputerName	PATHEXT=.COM;.EXE;.BAT;.CMD;.VBS;.VBE;.JS;.JSE;.WSF;.WSH;.MSC
NUMBER_OF_PROCESSORS=1	COMPUTERNAME= WIN-L1KDN79P80J
SESSIONNAME=Console	SystemDrive=C:"
"TEMP=C:\\Users\\Admin\\AppData\\Local\\Temp"	"USERNAME=admin"

Table 2- Some information received

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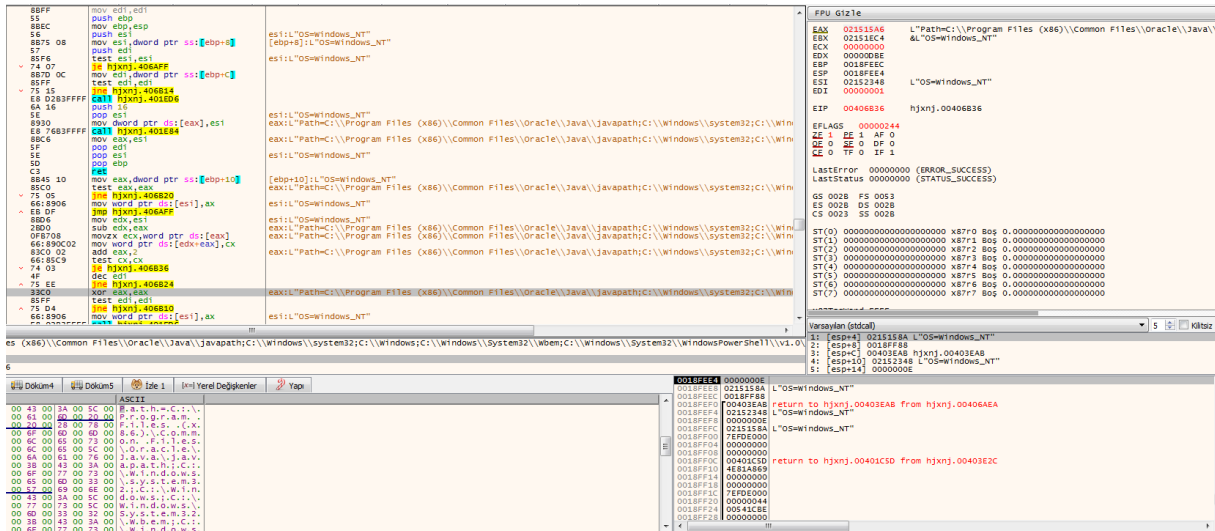


Figure 21- Detection of changes made

It is determined that the pest has added to the path from Environment variables.

These paths are:

C:\Program Files (x86)\Common Files\Oracle\Java\javapath

C:\Windows\System32\WindowsPowerShell\v1.0\

C:\Users\Admin\AppData\Local\Programs\Python\Python37\Scripts\

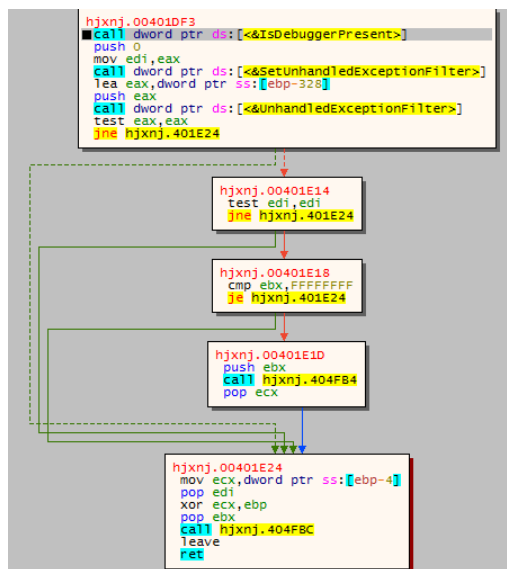


Figure 22- Anti-debugger detection

It used **antidebug technique** to detect the malware analysis environment, change the malware behavior or terminate itself. This makes it difficult for analysts to understand the inner workings of the malware.

Network Analysis

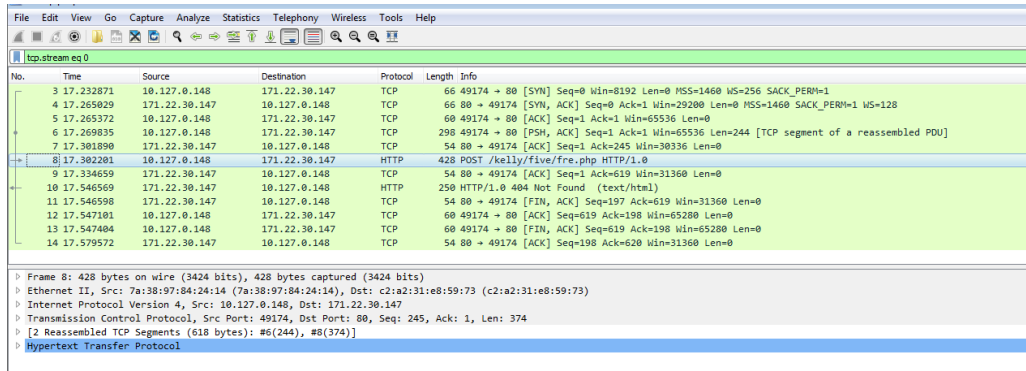


Figure 23- Wireshark Log Record

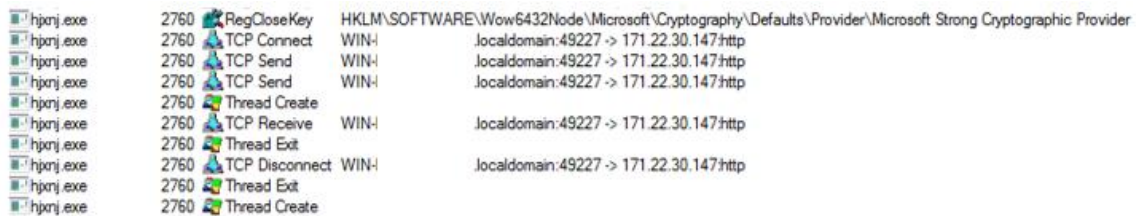


Figure 24- Process Monitor Log Record

It is observed that the malware first establishes a TCP connection with the IP address "171.[.22[.130[.147". Then it sends the "/kelly/five/fre[.]php http/1.0 POST" request by encrypting the data it collects on the target device. Then the TCP connection is closed.

IOCs

IPs :

IOC Type	IOC
IPv4	171[.]22[.]30[.]147
IPv4	188[.]114[.]96[.]13

DOMAINS:

IOC Type	IOC
Domain	/kelly/five/fre[.]php

HASHs:

IOC Type	IOC
MD5	6ac95d0ff18baaa2fa5bbfa1cbe4ff6e
MD5	b4ede3be28a02d4ad6033d5e8021e2f4
MD5	ea1faf5523c76af6706f84401b9809c0
SHA1	c557fbe7b5d90e06a8620f8ecf13c0a91dfc213c
SHA256	1b574a66c84924886daec4841e1b107258e019aaf6f336329ae8fae7cbd52a34
SHA256	4edd01345f58b9cc04a88ca15d6b82895f44f5b9cb51ad63b809de09029670ac
SHA256	8a5a024272361bb1ae12860c033bb52685d7b0ea3bce5fac46439f3f3ad36a84

Kellyzx.exe Yara Rule

```
import "hash"

rule kellyzx
{
  meta:
    author = "Kerime Gencay"
    date = "13/02/2023"
    description = "LokiBot YARA Rule"
    file_name = "kellyzx.exe"
    hash1 = "3BC68A0764CCC400C9A9F595E9F3ED3E"

  strings:
    $string1 = "7.33.18.75" wide
    $string2 = "RichEdit20W" wide
    $string3 = "%s%S.dll" wide

    $opc1 = {FF 15 38 81 40 00 B9 68 CE 40 00 8B F0 E8 F3 38 00 00 8D 85 D4 FD
    FF FF 68 00 78 43 00 50 E8 D9 2E 00 00 53 68 00 01 00 04 6A 02 53 53 8D 85
    D4 FD FF FF 68 00 00 00 C0 50 FF 15 F4 80 40 00} //allocate, deobfuscate and
    createfile

    $opc2 = {FF 15 04 81 40 00 8B C8 6A 00 41 F7 D9 1B C9 23 C8 51 FF 74 24 14
    6A 00 6A 01 FF 74 24 1C FF 74 24 1C FF 15 F4 80 40 00}

  condition:
    uint16(0) == 0x5A4D and
    (any of ($string*) or
    any of ($opc*))
}
```

hjxnj.exe Yara Rule

```
import "hash"

rule hjxnj
{
  meta:
    author = "Kerime Gencay"
    date = "13/02/2023"
    description = "LokiBot YARA Rule"
    file_name = "hjxnj.exe"
    hash1 = "CF86B09B00E89238F9205E6D469BCDD6"

  strings:

    $debug_artifact= "C:\\xampp\\htdocs\\c5892ccff2804af39d7bac9f5f6d95bb\\Loader\\Release\\Loader.pdb"

    $opc1 = {FF 15 B4 90 40 00 8B F0 33 C9 3B F1 75 04 33 C0 5E C3 66 39 0E 74
10 83 C0 02 66 39 08 75 F8 83 C0 02 66 39 08 75 F0 53 2B C6 8D 58 02 57 53
E8 C8 18 00 00}

  condition:

    uint16(0) == 0x5A4D and
    (any of ($opc*) or
    1 of ($debug_artifact*))
}
```

MITRE ATT&CK TABLE

Discovery	Command and Control	Defense Evasion	Persistence	Collection
T1012 Query Registry	T1071 Web Protocols	T1222 File and Directory Permissions	T1047 Create or Modify Systems	T1055 Data From Local System
T1082 Information Discovery		T1036 Creates Files inside the user directory		

MITIGATIONS

- Employ comprehensive cyber security solutions that include real-time threat detection, behavior monitoring, and malware removal capabilities. This can help identify and neutralize the presence of malicious files such as "**kellyzx.exe**" and "**hxnj.exe**."
- Ensure that all operating systems, applications, and software are up to date with the latest security patches. Regular updates can help address vulnerabilities that malware often exploits.
- Deploy reputable antivirus and anti-malware solutions that can proactively scan and remove malicious files. These tools can aid in detecting and eliminating threats like **kellyzx.exe** before they cause harm.
- Implement application whitelisting to restrict the execution of unauthorized applications. This can prevent the launch of malicious executables like "Kellyzx.exe" and "hxnj.exe."
- Provide training to users to recognize phishing emails, suspicious links, and attachments. User awareness can significantly reduce the likelihood of malware infiltration through social engineering tactics.
- Continuously monitor network traffic for unusual patterns and connections to known malicious IP addresses. This can help in early detection and mitigation of malicious activity.
- If a system is compromised, isolate it from the network to prevent the malware from spreading to other devices or servers.
- Maintain regular backups of critical data. In case of an attack, having backups can mitigate the impact of data loss.



LokiBot

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