Practical Malware Analysis & Triage

Malware Analysis Report

njRAT Remote Access Trojan

Aug 2022 | Zo | v1.0

Table of Contents

Executive Summary

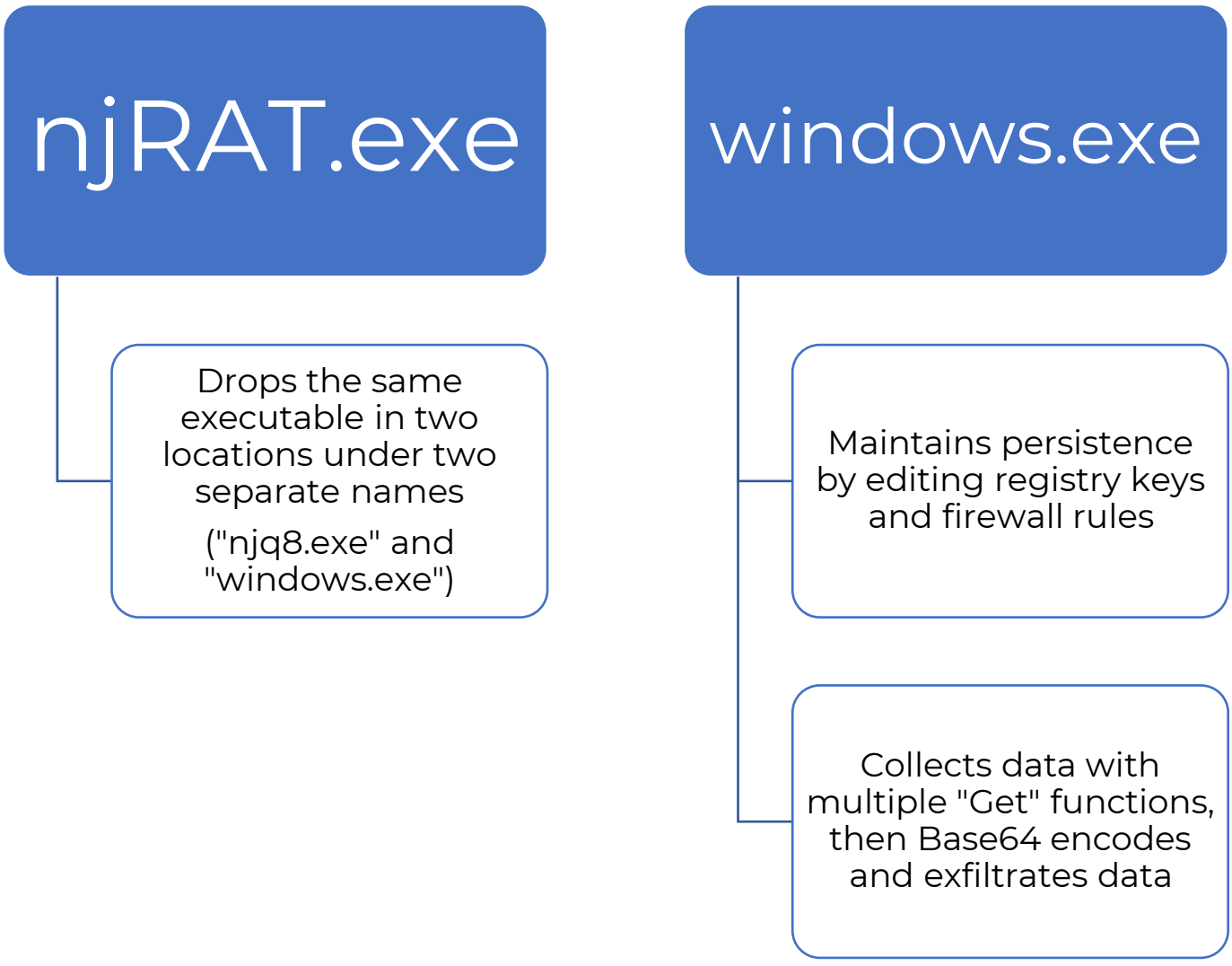
Sample Name	njRAT.exe
SHA256 hash	FD624AA205517580E83FAD7A4CE4D64863E95F62B34AC72647B1974A52822199
VirusTotal Detections	Flagged by 62/69 vendors as malicious: https://www.virustotal.com/gui/file/fd624aa205517580e83fad7a4ce4d64863e95f62b34ac72647b1974a52822199
Source	https://github.com/ytisf/theZoo/tree/master/malware/Binaries/njRAT-v0.6.4
Language	C# (.NET Framework)
Architecture	32 bit

njRAT is a remote access trojan that was first identified on January 1st, 2013. It consists of two payloads that are executed in succession, beginning with the initial dropper, and ending with “windows.exe” as the primary spyware and stealer payload. Symptoms of infection from this sample include continuous beaconing and exfiltration to the C2 address, “hxxp://zaaptoo.zapto.org”, a Microsoft .NET Framework “Unhandled exception” popup, and the executable “windows.exe” appearing in the %TEMP% directory. Since njRAT is currently one of the most widely used RATs in the world, callback URL’s and file names may vary depending on the threat actor and target.

A YARA signature rule and a list of IOCs are attached in Appendix A.

High-Level Technical Summary

njRAT consists of two parts: a dropper and an unpacked stage 2 spyware and stealer executable. It first unpacks its stage 2 payload, then begins stealing host information and user input. If the C2 domain, hxxp://zaaptoo.zapto[.]org, is reachable at the time of detonation it will begin exfiltrating immediately. Otherwise, it automatically detects if the domain comes back online and will exfiltrate data once a DNS query is successful.



Malware Composition

njRAT consists of the following components:

File Name	SHA256 Hash
njRAT.exe	FD624AA205517580E83FAD7A4CE4D64863E95F62B34AC72647B1974A52822199
njq8.exe	CE6421107031175F39E61D3BCC5A98D1D94190E250034E27CDBEBBADCBA084A4
windows.exe	CE6421107031175F39E61D3BCC5A98D1D94190E250034E27CDBEBBADCBA084A4

njRAT.exe:

The initial executable, typically sent in a phishing attachment.

njq8.exe:

A dropped file with the same hash as “windows.exe”, located at C:\njq8[.]exe. Appears to be a backup of the primary payload and is named after the Trojan’s original author (twitter handle “@njq8” appears in the strings output).

windows.exe:

Spyware that gathers system information such as computer name, browser passwords, camera and microphone access, and keystrokes, among other data. The file is located at C:\Users\<User>\AppData\Local\Temp\windows[.]exe. Copies user activity into a “.tmp” file, as shown below:

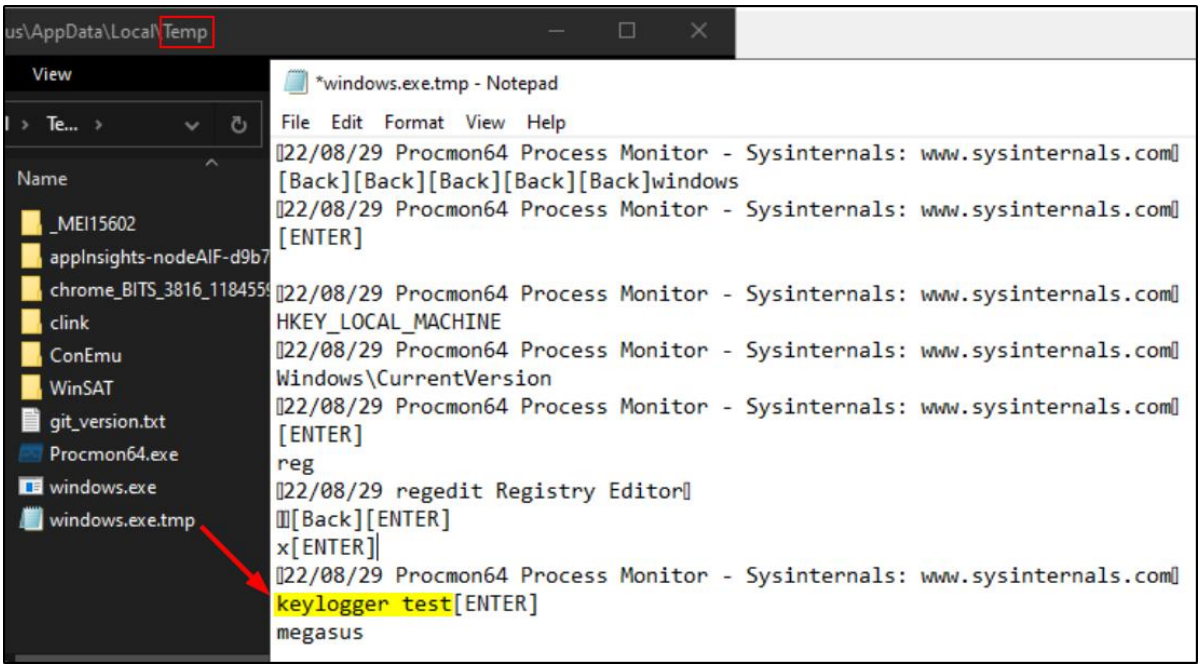


Fig 1: Keylogger output from windows.exe

Basic Static Analysis

Tools used: floss.exe, PEView, PEStudio, PEiD

After initial detonation of the malware, the only immediately visible indicator was a .NET Framework error:

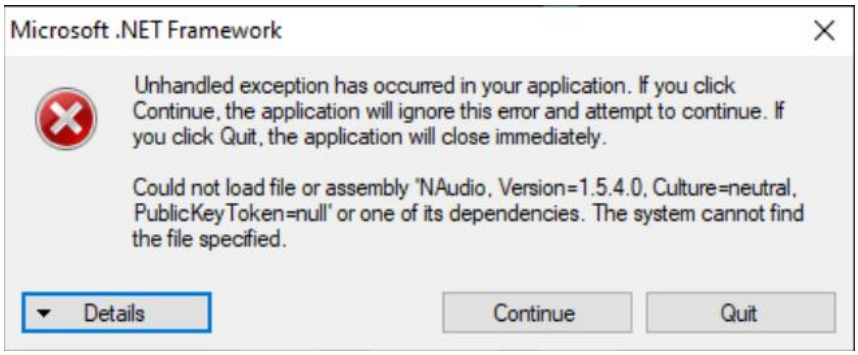


Fig 2: Initial error message

The first step after that was to look at the strings from the malware. I used "floss.exe" view strings and listed the most significant ones found in the table below:

Malware version, modules used, and link to author's twitter (likely indicates commercial malware)	Project : njRat Verison : 0.6.4 Coded By : njq8 FireFox Stealer : DarkSel Paltalk Stealer : protofag Chrome Stealer : RockingWithTheBest Opera Stealer : Black-Blood, KingCobra Icon Changer : Miharbi Thnx To : MaSad ,CoBrAxXx Twitter : https://twitter.com/njq8
Executables referenced	ClassLibrary1.exe EnKSaR.HaCKeR.exe njq8.exe
Domains	zaaptoo.zapto[.]org
Interesting commands	netsh firewall add allowedprogram "
"mscorlib" referenced - an indicator that the malware was written in C#	FLOSS static ASCII strings !This program cannot be run in DOS mode. `.sdata @.reloc 1System.Resources.ResourceReader, mscorlib, PADPADPF !This program cannot be run in DOS mode.

Analyzing the binary in PEStudio provided the sample's file hash, architecture, and compilation time for the malware, which was **"Fri Sep 27 08:00:20 2013".** It also listed that the original filename of "windows.exe" as "ClassLibrary1.exe" and "njRAT.exe" as "EnKSaR.HaCKeR.exe", which were both referenced in the strings.

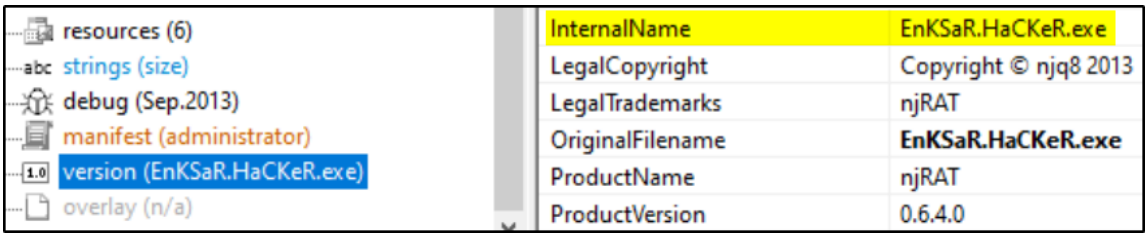


Fig 3: PEStudio file analysis

The malware is unlikely to be packed since PEview showed no significant difference between the malware's "Size of Raw Data" and "Virtual Size", and since PEiD was unable to detect a known packer for this executable (output lists "Nothing found").

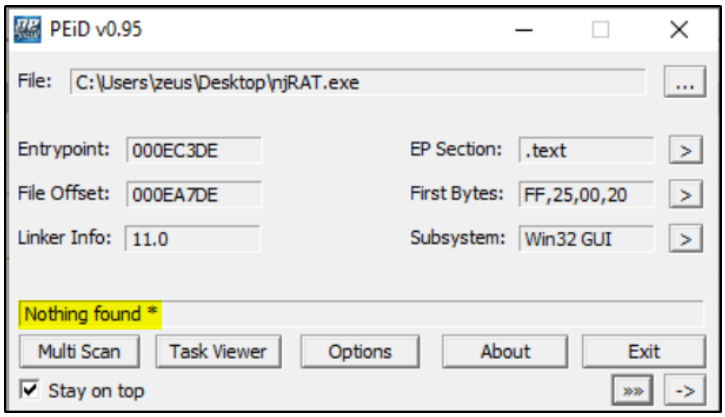


Fig 4: No malware packer identified

Multiple imported API functions from the stage 2 executable “windows.exe” were potential spyware indicators. A few are highlighted in the example below:

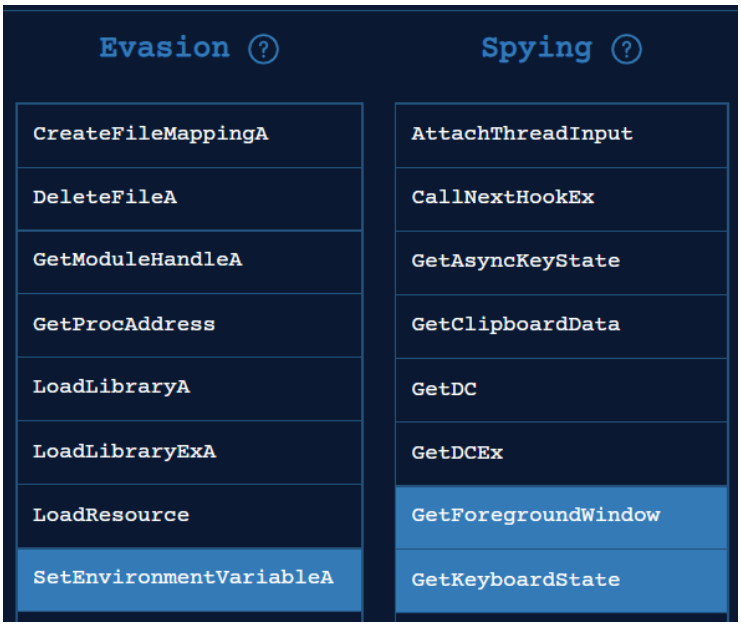


Fig 5: Suspicious functions mapped, source: malapi.io

Basic Dynamic Analysis

Tools used: TCPView, inetsim, Wireshark, netcat, procmon (Process Monitor)

The malware's beaconing activity was visible in TCPView, where it would create a new TCP SYN connection attempt every few seconds to remote port 1177.

Process Name	Process ID	Protocol	State	Local Address	Local Port	Remote Address	Remote Port
svchost.exe	800	TCP	Listen	0.0.0.0	135	0.0.0.0	0
System	4	TCP	Listen	10.0.0.4	139	0.0.0.0	0
System	4	TCP	Listen	169.254.176.82	139	0.0.0.0	0
windows.exe	1236	TCP	Syn Sent	10.0.0.4	1422	10.0.0.3	1177

Fig 6: Beaconing from windows.exe in TCPView

These connections could only start after a successful DNS query to the C2 domain "zaaptoo.zapto[.]org". The successful connection was simulated by inetsim and can be seen in the Wireshark packet capture below.

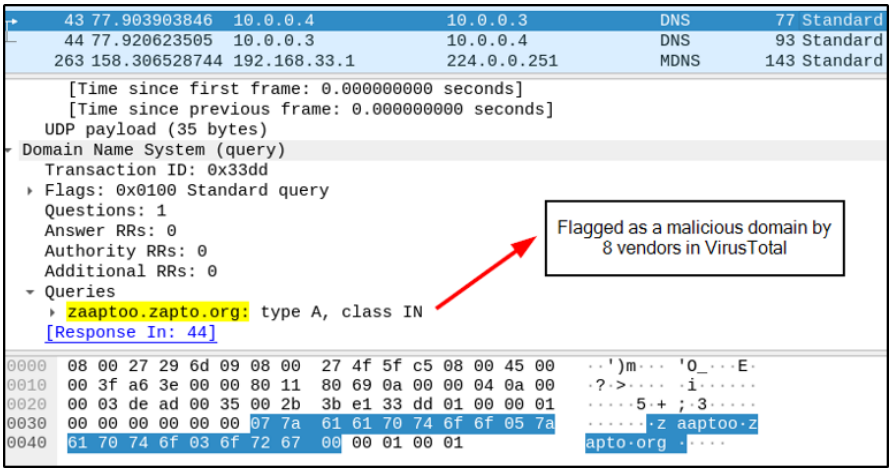


Fig 7: Initial beacon to command-and-control URL

After reaching the C2 URL, it began encoding and exfiltrating data to this address. I captured the data in transit by editing the hosts file to point "zaaptoo.zapto[.]org" to the virtual machine's loopback address (127.0.0.1) and then set up a netcat listener on port 1177.

To verify if any other changes were made on the system, I checked the process tree in procmon for a basic overview njRAT's activity.

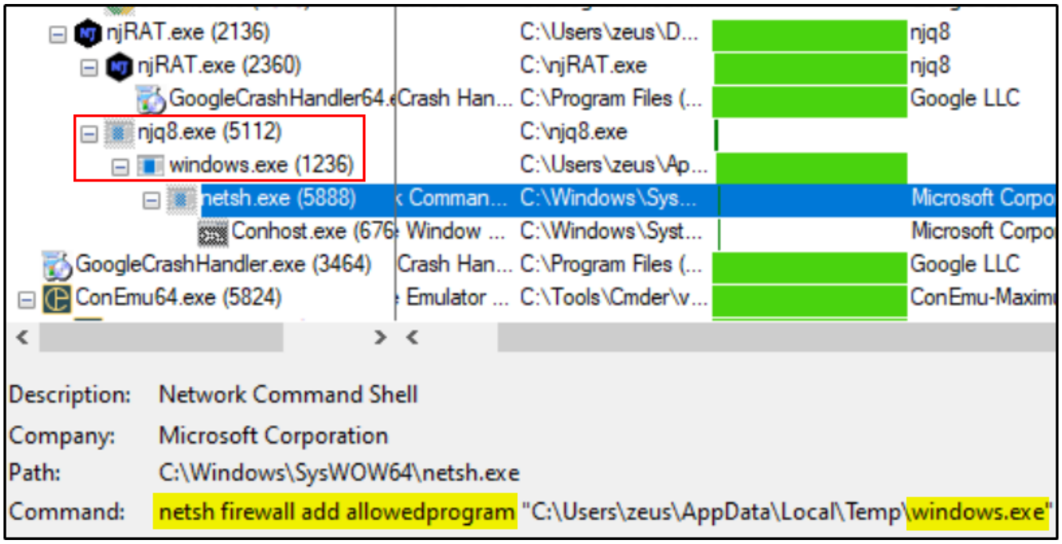
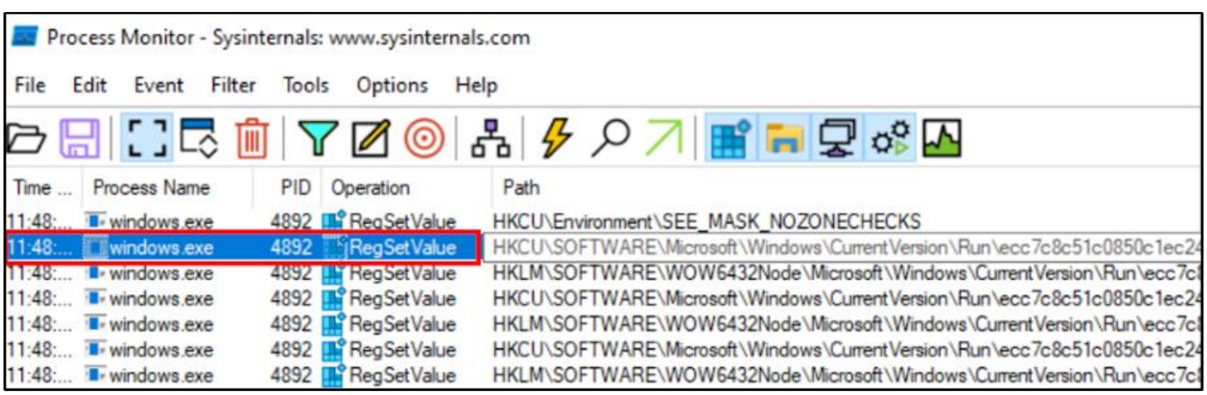


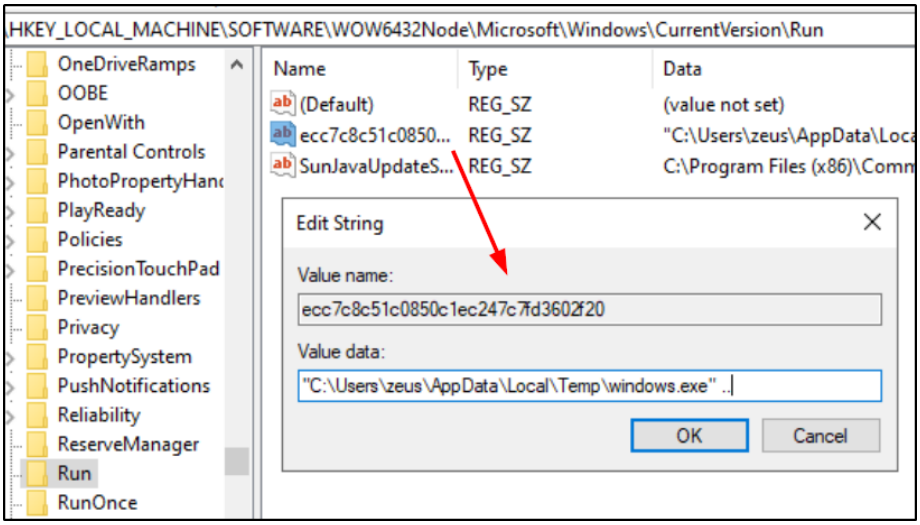
Fig 8: Process tree for njRAT in procmon

Here we can see that njRAT drops two executables. The primary focus is the stage 2 payload, windows.exe, which is seen whitelisting itself in Defender.

I filtered procmon to look for any other activity from windows.exe, focusing on file and registry key changes. I found that the binary was continuously recreating two "Run" keys in the registry, both under the name "ecc7c8c51c0850c1ec247c7fd3602f20".



Checking these values in Registry Editor reveals that windows.exe is being launched at startup, and that both the registry entry and file itself will respawn if deleted.



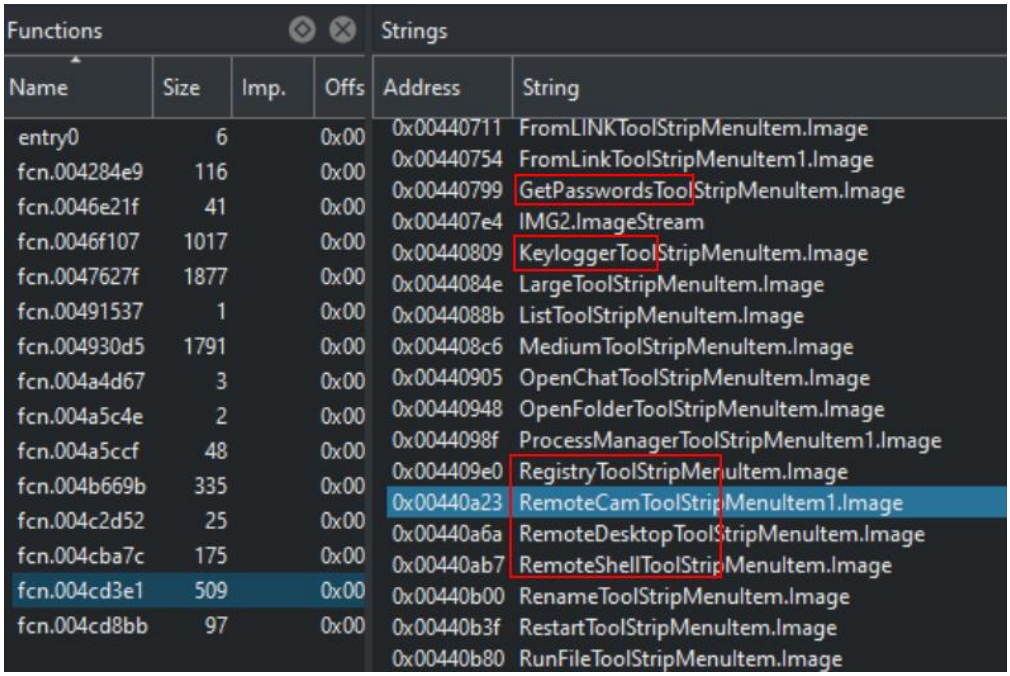
Advanced Static Analysis

Tools used: dnSpy, Cutter

Since the malware sample was written in C#, dnSpy was able to recreate what the code potentially looked like. Below is a function that retrieves and stores the computer hostname:

```
198     // Token: 0x0600002B RID: 43 RVA: 0x000AAB64 File Offset: 0x000A9D64
199     internal unsafe static string GetComputerName()
200     {
201         Span<char> span = new Span<char>(stackalloc byte[(UIntPtr)32], 16);
202         Span<char> span2 = span;
203         uint length = (uint)span2.Length;
204         if (Interop.Kernel32.GetComputerName(MemoryMarshal.GetReference<char>(span2), ref length) == 0)
205         {
206             return null;
207         }
208         return span2.Slice(0, (int)length).ToString();
```

Loading the main executable into Cutter rendered more of an insight into the data collected by the binary, including remote desktop and registry manipulation capabilities.



Functions

Name	Size	Imp.	Offs
entry0	6		0x00
fcn.004284e9	116		0x00
fcn.0046e21f	41		0x00
fcn.0046f107	1017		0x00
fcn.0047627f	1877		0x00
fcn.00491537	1		0x00
fcn.004930d5	1791		0x00
fcn.004a4d67	3		0x00
fcn.004a5c4e	2		0x00
fcn.004a5ccf	48		0x00
fcn.004b669b	335		0x00
fcn.004c2d52	25		0x00
fcn.004cba7c	175		0x00
fcn.004cd3e1	509		0x00
fcn.004cd8bb	97		0x00

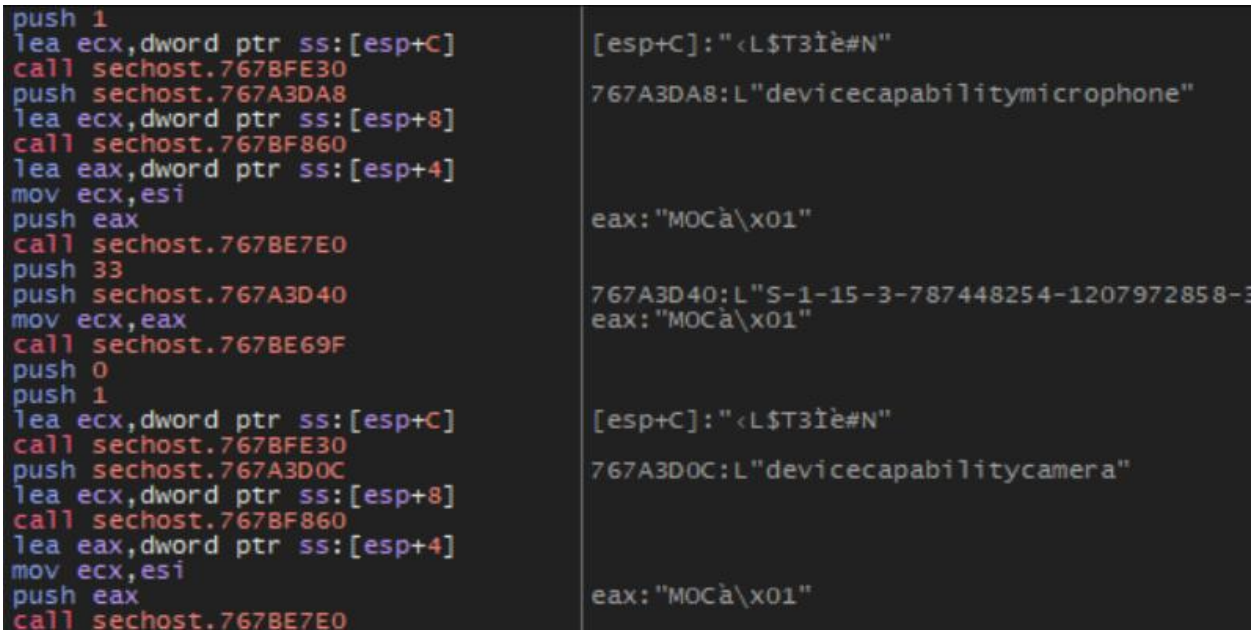
Strings

Address	String
0x00440711	FromLINKToolStripMenuItem.Image
0x00440754	FromLinkToolStripMenuItem1.Image
0x00440799	GetPasswordsToolStripMenuItem.Image
0x004407e4	IMG2.ImageStream
0x00440809	KeyloggerToolStripMenuItem.Image
0x0044084e	LargeToolStripMenuItem.Image
0x0044088b	ListToolStripMenuItem.Image
0x004408c6	MediumToolStripMenuItem.Image
0x00440905	OpenChatToolStripMenuItem.Image
0x00440948	OpenFolderToolStripMenuItem.Image
0x0044098f	ProcessManagerToolStripMenuItem1.Image
0x004409e0	RegistryToolStripMenuItem.Image
0x00440a23	RemoteCamToolStripMenuItem1.Image
0x00440a6a	RemoteDesktopToolStripMenuItem.Image
0x00440ab7	RemoteShellToolStripMenuItem.Image
0x00440b00	RenameToolStripMenuItem.Image
0x00440b3f	RestartToolStripMenuItem.Image
0x00440b80	RunFileToolStripMenuItem.Image

Advanced Dynamic Analysis

Tools used: x32dbg

Debugging njRAT revealed similar information as found with advanced static analysis, mainly including the vast information-gathering utilities of this malware.



Indicators of Compromise

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

Network Indicators

Process Name	Process ID	Protocol	State	Local Address	Local Port	Remote Address	Remote Port
svchost.exe	800	TCP	Listen	0.0.0.0	135	0.0.0.0	0
System	4	TCP	Listen	10.0.0.4	139	0.0.0.0	0
System	4	TCP	Listen	169.254.176.82	139	0.0.0.0	0
windows.exe	1236	TCP	Syn Sent	10.0.0.4	1422	10.0.0.3	1177

Fig 9: Windows.exe exfiltration attempts to C2 domain (remote address is inetsim)

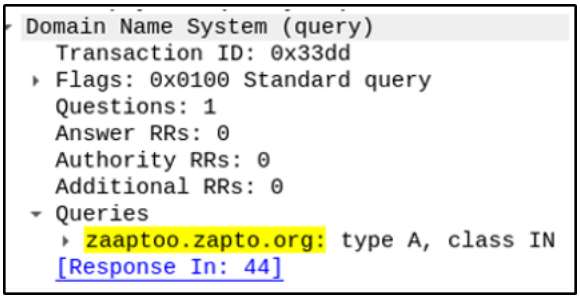


Fig 10: WireShark Packet Capture of initial beacon check-in

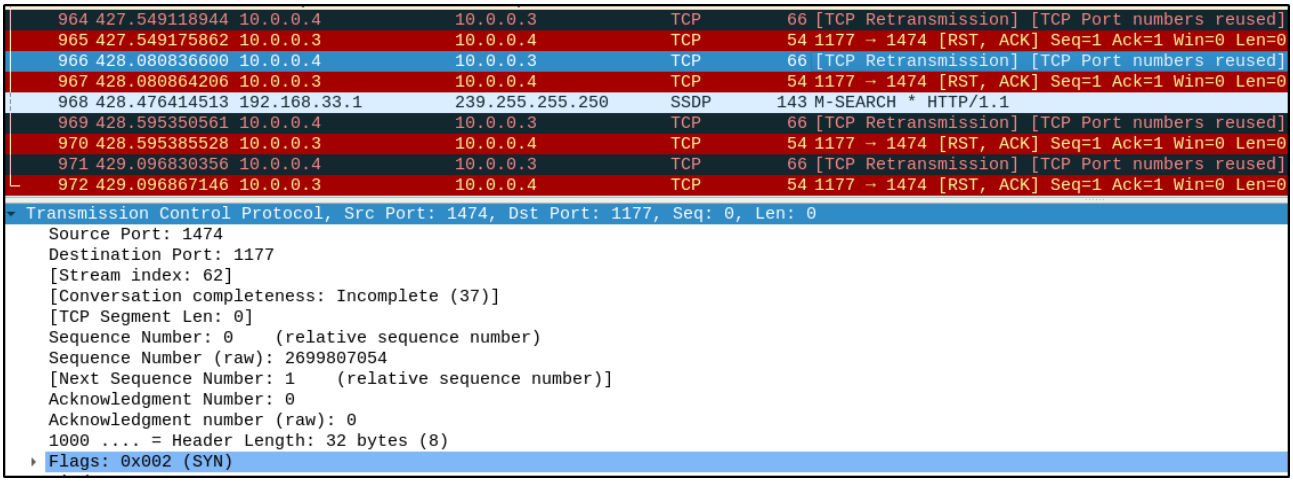


Fig 11: WireShark packet capture of spurious retransmissions during exfiltration attempts

Host-based Indicators

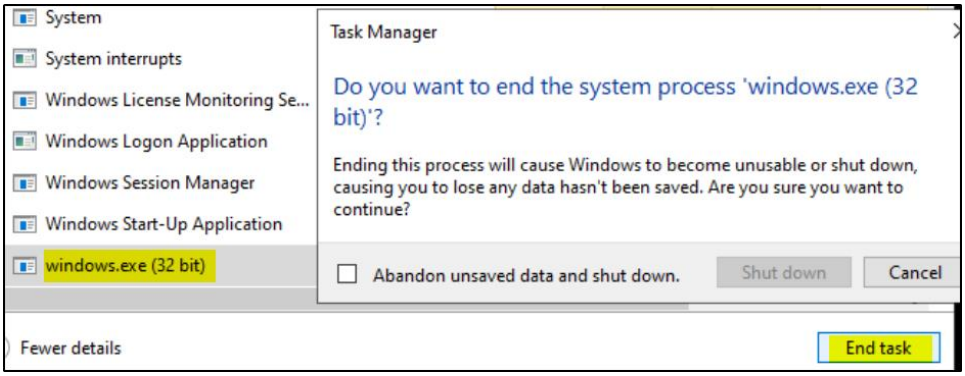


Fig 12: Windows.exe running in Task Manager's Details and Startup tabs

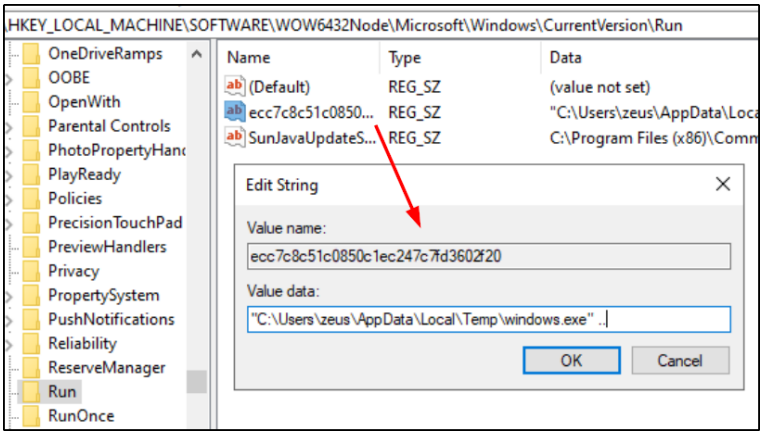


Fig 13: Windows.exe registry entry for persistence

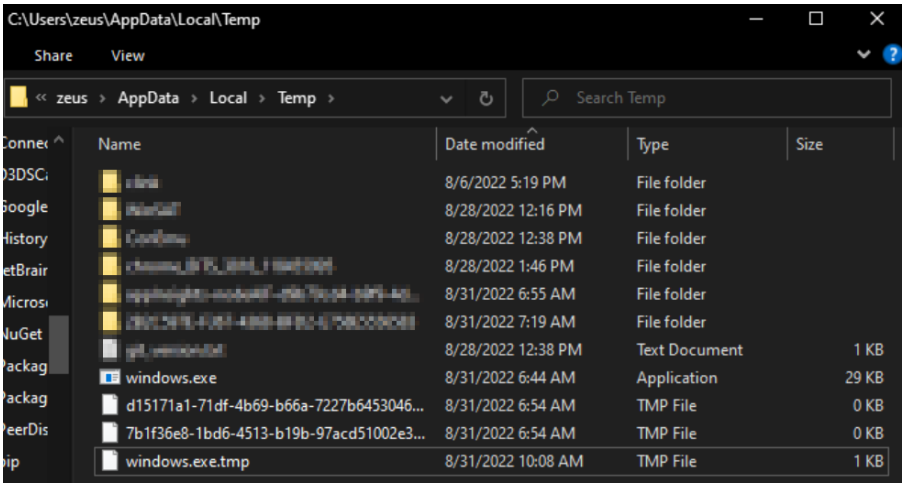


Fig 14: Location of the stage 2 payload and log file

Appendices

A. njRAT Yara Rule

```
rule njRAT {

    meta:
        last_updated = "2022-08-29"
        author = "Z"
        description = "Yara rule for njRAT.exe"

    strings:
        $string1 = "EnKSaR.HaCKeR"
        $string2 = "njRAT.exe"
        $string3 = "https://twitter.com/njq8"
        $PE_magic_byte = "MZ"

    condition:
        $PE_magic_byte at 0 and
        ($string1 and $string2 and $string3)
}
```

B. Callback URLs

Domain	Port
hxxp://zaaptoo.zapto.org	1177

C. Registry keys

- HKCU\SOFTWARE\Microsoft\Windows\CurrentVersion\Run\ecc7c8c51c0850c1ec247c7fd3602f20
- HKLM\SOFTWARE\WOW6432Node\Microsoft\Windows\CurrentVersion\Run\ecc7c8c51c0850c1ec247c7fd3602f20

D. Files

- C:\njRAT[.]exe
- C:\njq8[.]exe
- C:\Users\<User>\AppData\Local\Temp\windows[.]exe