MWR LABS

UAC 0day, all day!

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Disclaimer

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Modern IE Virtual Machine

90-day trial Windows 7/10

YOUR MONEY IS NO GOOD HERE!

What is UAC

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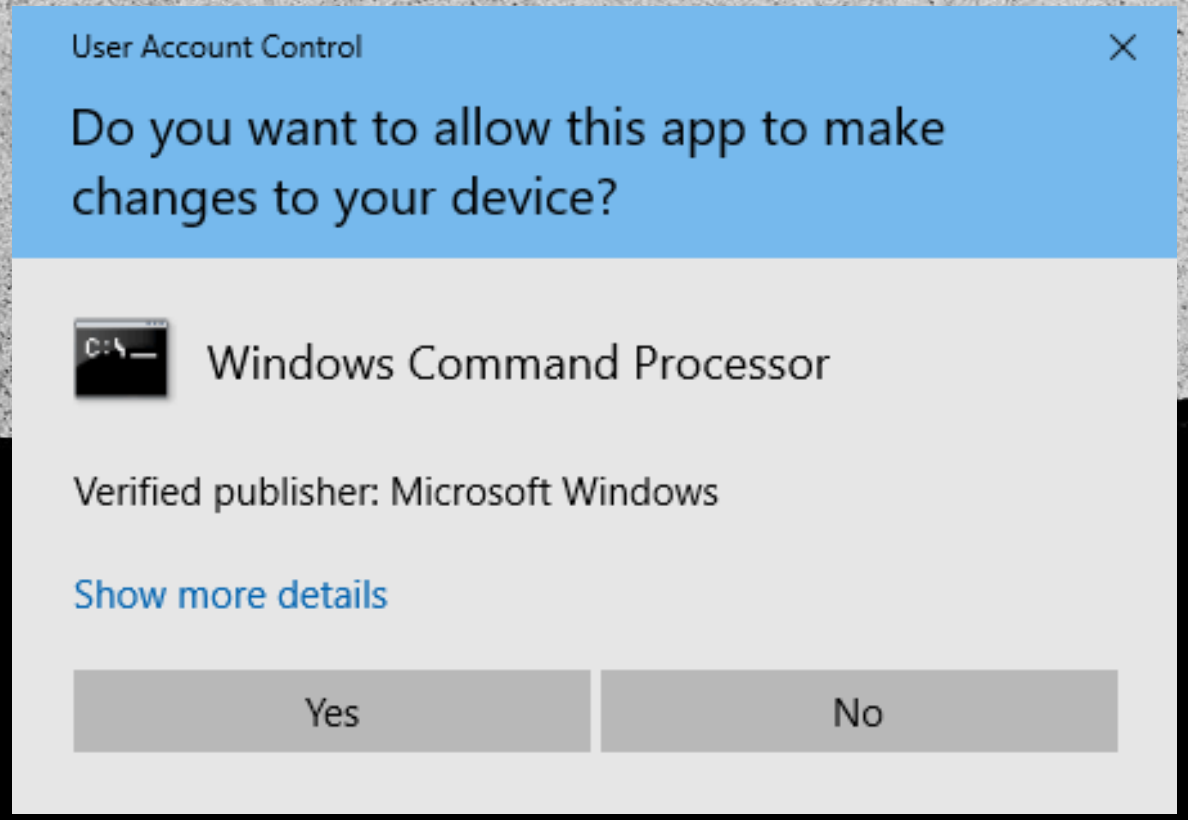

Is it a bird, is it a plane..?

Is it a compatibility feature,

is it a security boundary..?

" MAYBE THE ANSWER DOESN'T MATTER, ONLY THE RESULT! "

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Talking Points

UAC Background

Elevated copy WUSA/IFileOperation

Dll Hijacking

WinSxS

Registry Madness

Environment Variable

COM Handlers

Token Manipulation

There will be labs throughout,
targeting Win 7-10RS (yes Oday as well)

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First some humour

Why Microsoft will not treat UAC as a security boundary

|

|-> Event Viewer -> Action -> Open...

|

|-> Device Manager -> Help Topics -> Print -> Find Printer...

mmc.exe	< 0.01	76,772 K	97,560 K	4200 Microsoft Managemen...	Microsoft Corporat...	DESKTOP-GALB...	High
powershell.exe	< 0.01	58,564 K	69,212 K	4084 Windows PowerShell	Microsoft Corporat...	DESKTOP-GALB...	High
conhost.exe		3,540 K	12,352 K	10964 Console Window Host	Microsoft Corporat...	DESKTOP-GALB...	High
procexp64.exe	0.19	28,564 K	50,464 K	11840 Sysinternals Process ...	Sysinternals - ww...	DESKTOP-GALB...	High

AIN'T NOBODY GOT TIME TO TRIAGE THAT!

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How does UAC work

Split token Administrators

Windows PowerShell

```
PS C:\Users\b33f> whoami /groups

GROUP INFORMATION
-----------------

Group Name                                                     Type             SID
============================================================== ================ ==============
Everyone                                                       Well-known group S-1-1-0
NT AUTHORITY\Local account and member of Administrators group Well-known group S-1-5-114
BUILTIN\Administrators                                         Alias            S-1-5-32-544
BUILTIN\Performance Log Users                                  Alias            S-1-5-32-559
BUILTIN\Users                                                  Alias            S-1-5-32-545
NT AUTHORITY\INTERACTIVE                                       Well-known group S-1-5-4
CONSOLE LOGON                                                  Well-known group S-1-2-1
NT AUTHORITY\Authenticated Users                               Well-known group S-1-5-11
NT AUTHORITY\This Organization                                 Well-known group S-1-5-15
NT AUTHORITY\Local account                                     Well-known group S-1-5-113
LOCAL                                                          Well-known group S-1-2-0
NT AUTHORITY\NTLM Authentication                               Well-known group S-1-5-64-10
                                                               Unknown SID type S-1-5-32-4028125
                                                               Unknown SID type S-1-5-32-2745667
                                                               Unknown SID type S-1-5-32-1034403
Mandatory Label\Medium Mandatory Level                         Label            S-1-16-8192
PS C:\Users\b33f>
PS C:\Users\b33f> Get-TokenPrivs -ProcID 1424

[?] PID 1424 --> notepad
[+] Process handle: 2676
[+] Token handle: 2540
[+] Token has 5 privileges:

LUID Privilege
---- ---------
  19 SeShutdownPrivilege
  23 SeChangeNotifyPrivilege
  25 SeUndockPrivilege
  33 SeIncreaseWorkingSetPrivilege
  34 SeTimeZonePrivilege


PS C:\Users\b33f> _
```

Auto-Elevating Binaries

```
                        |-> sigcheck.exe -m C:\Windows\System32\Taskmgr.exe
                        |
-> Powershell grep or sigcheck
   |
   |-> Get-Content -Path C:\Windows\System32\Taskmgr.exe |Select-String -Pattern "autoElevate"

-> Reading manifests at scale!
   |
   |-> Get-AutoElevate -Path C:\Windows\system32 -MaxDepth 1
       |
       |-> It's slow mkaaay, grab a coffee!

-> Also MMC snap-ins
-> Also COM objects (eg: IFileOperation)
```

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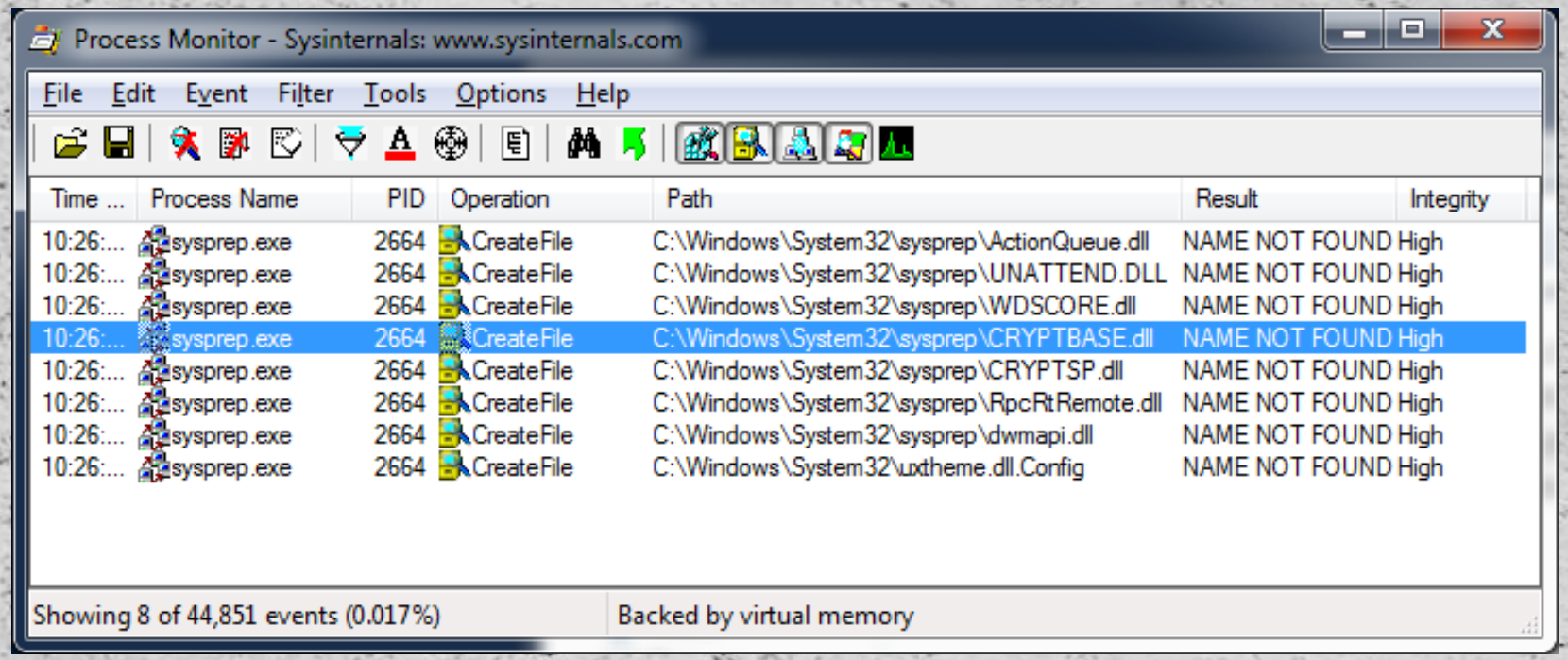
Win7 -> sysprep

-> UAC bypass archetype by Leo Davidson
|
|-> Win 7,8



-> Good one b33f, but writing to "C:\Windows*" requires a UAC bypass, sigh...

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Windows Update Standalone Installer (WUSA)

|-> makecab C:\Some\Evil.dll C:\Some\Suspicious.cab

wusa C:\Some\Suspicious.cab /extract:C:\Windows\Some\Path

¯_(ツ)_/¯ Yea, no joke guys <-| ¯_(ツ)_/¯ ¯_(ツ)_/¯ ¯_(ツ)_/¯

-> Microsoft removed the "/extract" flag in Windows 10

- Implement a full UAC bypass for sysprep

- Or C:\Windows\System32\cliconfg.exe

- Or C:\Windows\System32\migwiz\migwiz.exe

  |

  |-> Used by Carberp banking malware

  |

  |-> https://github.com/hfiref0x/UACME/blob/master/Source/Akagi/methods/carberp.c

=> These methods work on Win 7,8,(8.1)

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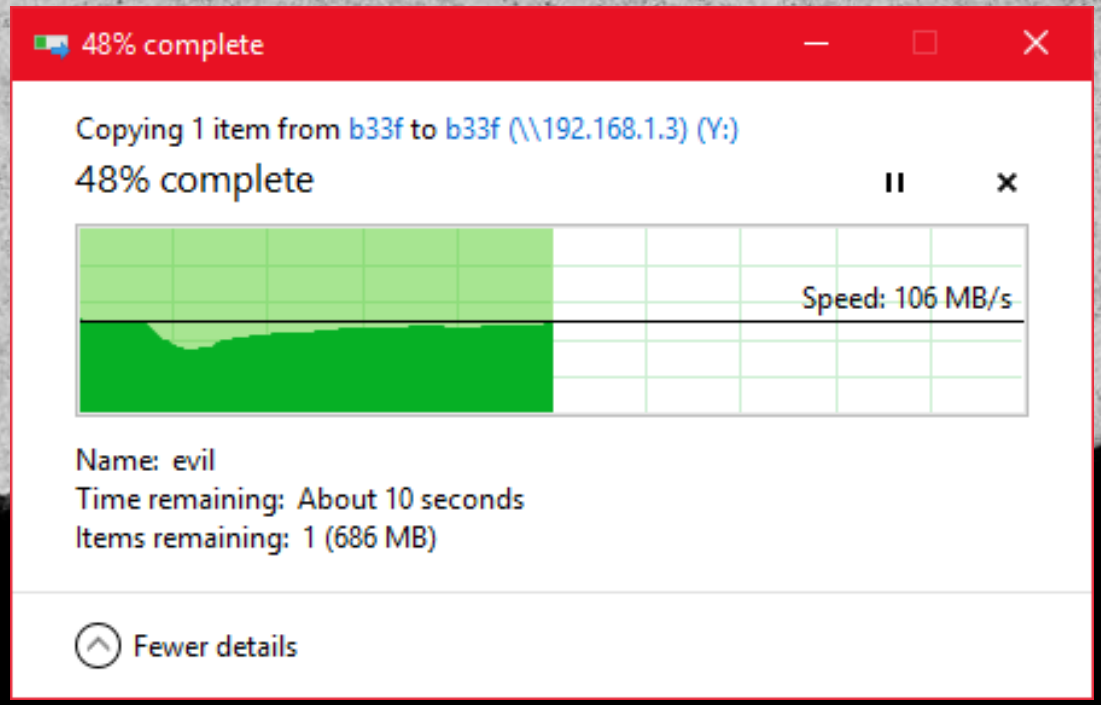
MSFT Kills WUSA

- When people elevate banking malware using wusa, it's time to take action!
- But remember the IFileOperation COM object?
  - -> Vista+
  - -> Can auto-elevate if: Trusted binary, Trusted location (eg. explorer, powershell, etc.)
  - -> Copy/Delete/Move/Create/Rename

You have definitely used this COM object!



(1) Find dll hijacking opportunity

(2) Create payload dll

(3) Create IFileOperation dll

(4) Inject IFileOperation dll into explorer

(5) Auto-elevated copy of payload to privileged directory

(6) Profit!

Traditional Abuse of IFileOperation

This works, but:

IOC heavy, inflexible(, a bit sad!)

We can do better!

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- Helper library to obtain information about processes and device drivers.
  |
  |-> Essentially identifies a process from it's Process Environment Block (PEB)
        |
        |-> Semi-Documented Structure

```
0:007> !peb
PEB at 000000aaecef9000
    InheritedAddressSpace:    No
    ReadImageFileExecOptions: No
    BeingDebugged:            Yes
    ImageBaseAddress:         00007ff6676f0000
    Ldr                       00007ffe83f2b340
    Ldr.Initialized:          Yes
    Ldr.InInitializationOrderModuleList: 0000021e178c2870 . 0000021e178cf890
    Ldr.InLoadOrderModuleList:           0000021e178c29e0 . 0000021e178d0a40
    Ldr.InMemoryOrderModuleList:         0000021e178c29f0 . 0000021e178d0a50
                    Base TimeStamp                     Module
            7ff6676f0000 685de393 Jun 27 01:19:31 2025 C:\WINDOWS\system32\notepad.exe
            7ffe83dd0000 b79b6ddb Aug 13 00:18:51 2067 C:\WINDOWS\SYSTEM32\ntdll.dll
            7ffe82290000 f5fa43df Oct 10 03:41:35 2100 C:\WINDOWS\System32\KERNEL32.DLL
            7ffe807a0000 a0527b0c Mar 27 11:33:32 2055 C:\WINDOWS\System32\KERNELBASE.dll
            7ffe82340000 8e7c3351 Oct 01 21:57:53 2045 C:\WINDOWS\System32\ADVAPI32.dll
            7ffe82170000 3280d1b7 Nov 06 17:58:15 1996 C:\WINDOWS\System32\msvcrt.dll
            7ffe83d70000 b4c11302 Feb 04 23:36:34 2066 C:\WINDOWS\System32\sechost.dll
            7ffe7f5a0000 1c48ce6a Jan 14 06:51:22 1985 C:\WINDOWS\SYSTEM32\ntmarta.dll
            7ffe7cc00000 1831e765 Nov 12 04:34:45 1982 C:\WINDOWS\SYSTEM32\usermgrcli.dll
    SubSystemData:     00007ffe7ed602c0
    ProcessHeap:       0000021e178c0000
    ProcessParameters: 0000021e178c1fd0
    CurrentDirectory:  'C:\Users\b33f\'
    WindowTitle:       'C:\Users\b33f\AppData\Roaming\Microsoft\Windows\Start Menu\Programs\Access
    ImageFile:         'C:\WINDOWS\system32\notepad.exe'
    CommandLine:       '"C:\WINDOWS\system32\notepad.exe" '
    DllPath:           < Name not readable >
    Environment:       0000021e178c0fc0
```

=> A process has access to it's own memory though, mmmmm...?

Tricking the Process Status API (PSAPI)

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Masquerade -PEB Demo

- YOLO process integrity
  |
  |-> Get-WmiObject Win32_Process -Filter "ProcessId = '$PID'"
  |
  |-> Sysinternals Process Explorer

- C/C++/C# payloads can use this technique to impersonate explorer and auto-elevate IFileOperation
  |
  |-> UACME implementation: https://github.com/hfiref0x/UACME/blob/master/Source/Akagi/sup.c#L809

We don't need this
because PowerShell is
a trusted executable ¯_(ツ)_/¯ !

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In-Memory IFileOperation

- Stephen Toub December 2007 MSDN magazine
  |
  |-> https://github.com/FuzzySecurity/PowerShell-Suite/tree/master/Bypass-UAC/images
- Slightly modified his library to REQUIREELEVATION & SILENT

```
PS C:\> Invoke-IFileOperation
PS C:\> $IFileOperation |Get-Member

        TypeName: FileOperation.FileOperation

Name                MemberType      Definition
----                ----------      ----------
CopyItem            Method          void CopyItem(string source, string destination, string newName)
DeleteItem          Method          void DeleteItem(string source)
Dispose             Method          void Dispose(), void IDisposable.Dispose()
Equals              Method          bool Equals(System.Object obj)
GetHashCode         Method          int GetHashCode()
GetType             Method          type GetType()
MoveItem            Method          void MoveItem(string source, string destination, string newName)
NewItem             Method          void NewItem(string folderName, string name, System.IO.FileAttributes attrs)
PerformOperations   Method          void PerformOperations()
RenameItem          Method          void RenameItem(string source, string newName)
ToString            Method          string ToString()
```

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Invoke -IFileOperation Demo

```
$IFileOperation.MoveItem("C:\Some\Source.file","C:\Some\Destination\Path\","Destination.file")
$IFileOperation.PerformOperations()
```

=> This works on Win 7,8,8.1,10,10RS1

- Implement a full UAC bypass for
  | "C:\Windows\System32\mmc.exe rsop.msc"
  |
  |-> Win 7,8,8.1,10,10RS1

- Or "mmc compmgmt.msc"
  |
  |-> Win 7,8,8.1,10

- Or C:\Windows\System32\oobe\setupsqm.exe
  |
  |-> Win 7,8,8.1

- Or C:\Windows\System32\odbcad32.exe
  |
  |-> Win 7

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Congratulations, 0day!

- "mmc compmgmt.msc" -> C:\Windows\System32\elsext.dll
  |
  |-> Trivia: Win10 RS1 not vulnerable but RS2 has the same hijacking issue!

- C:\Windows\System32\odbcad32.exe -> C:\Windows\System32\BidLab.dll
  |
  |-> Trivia: Win10 RS2 also has a hijacking opportunity with secruntime.dll

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Windows Side-By-Side Assembly

- Global resource cache => C:\Windows\WinSxS
  - -> Introduced as a solution to the so-called dll hell problem
  - -> Completely breaks UAC dll hijacking assumptions, truly Oday everywhere!
  - -> Also a good place to bypass poor application lockdown ;)

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Sysprep Case-Study

- sigcheck64.exe -m C:\Windows\System32\Sysprep\sysprep.exe
|
|->

```
<dependency>
   <dependentAssembly>
      <assemblyIdentity>
            language="*"
            name="Mircrosoft.Windows.Commom-Controls"
            processorArchitecture="amd64"
            publicKeyToken="6595b64144ccf1df"
            type="win21"
            version="6.0.0.0"
            />
   </depedentAssembly>
</dependency>
```

- procmon
|
|->

sysprep.exe	4616	CreateFile	C:\Windows\System32\Sysprep\sysprep.exe.Local	NAME NOT
sysprep.exe	4616	CreateFile	C:\Windows\WinSxS\amd64_microsoft.windows.common-controls_6595b64144ccf1df_6.0.15063.0_none_108e4f62dfe5d999	SUCCESS
sysprep.exe	4616	CloseFile	C:\Windows\WinSxS\amd64_microsoft.windows.common-controls_6595b64144ccf1df_6.0.15063.0_none_108e4f62dfe5d999	SUCCESS

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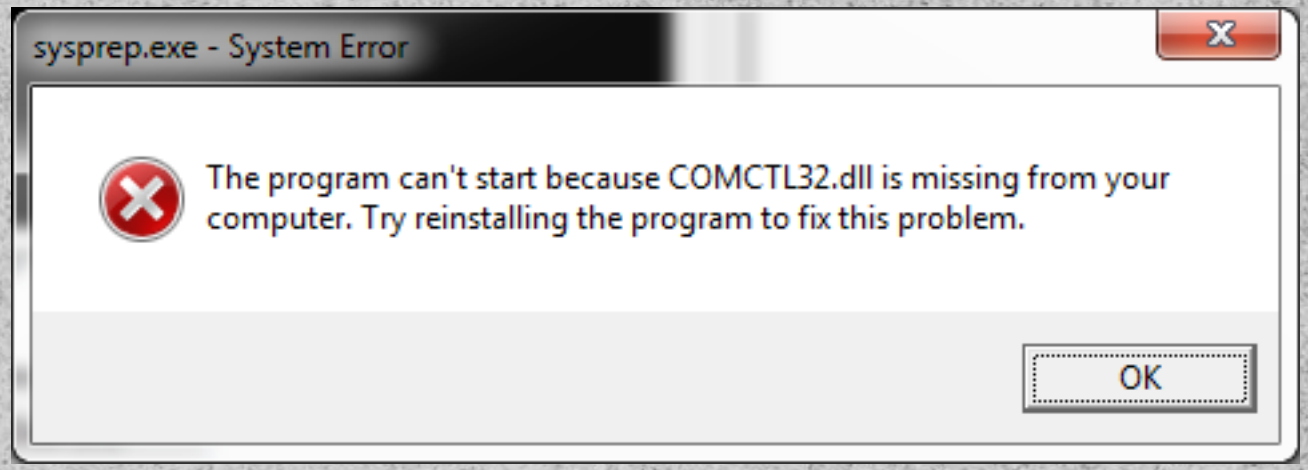
- Create: C:\Windows\System32\sysprep\
  - |-> sysprep.exe.local
    - |-> amd64_microsoft.windows.common-controls_6595b64144ccf1df_6.0.7601.17514_none_fa396087175ac9ac
      - |-> comctl32.dll

A Different Kind Of DLL Hell?



- Create the entire folder structure somewhere (eg. Desktop/%temp%) and then move it!
  - |-> $IFileOperation.MoveItem("C:\Some\Path\sysprep.exe.local","C:\Windows\System32\sysprep","sysprep.exe.local")
  - |-> $IFileOperation.PerformOperations()

- Implement a full UAC bypass for C:\Windows\System32\msconfig.exe
  |
  |-> Win 7,8,8.1,10,10RS1

- Or C:\Windows\System32\MultiDigiMon.exe
  |
  |-> Win 7,8,8.1,10,10RS1

Lab Time!

¯_(ツ)_/¯

Oday's but what can you do when every elevated binary can be hijacked?

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Hijacking COM Handlers

- Windows Operating System Archaeology - @subTee & @enigmaOx3
  |
  |-> https://www.youtube.com/watch?v=3gz1QmiMhss

- CLSIDs and Junction Folders - Vault7 CIA Leak
  |
  |-> https://wikileaks.org/ciav7p1/cms/page_13763373.html

=> Persistence but what about elevated COM hijacks?

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A Closer Look At CIA Persistence

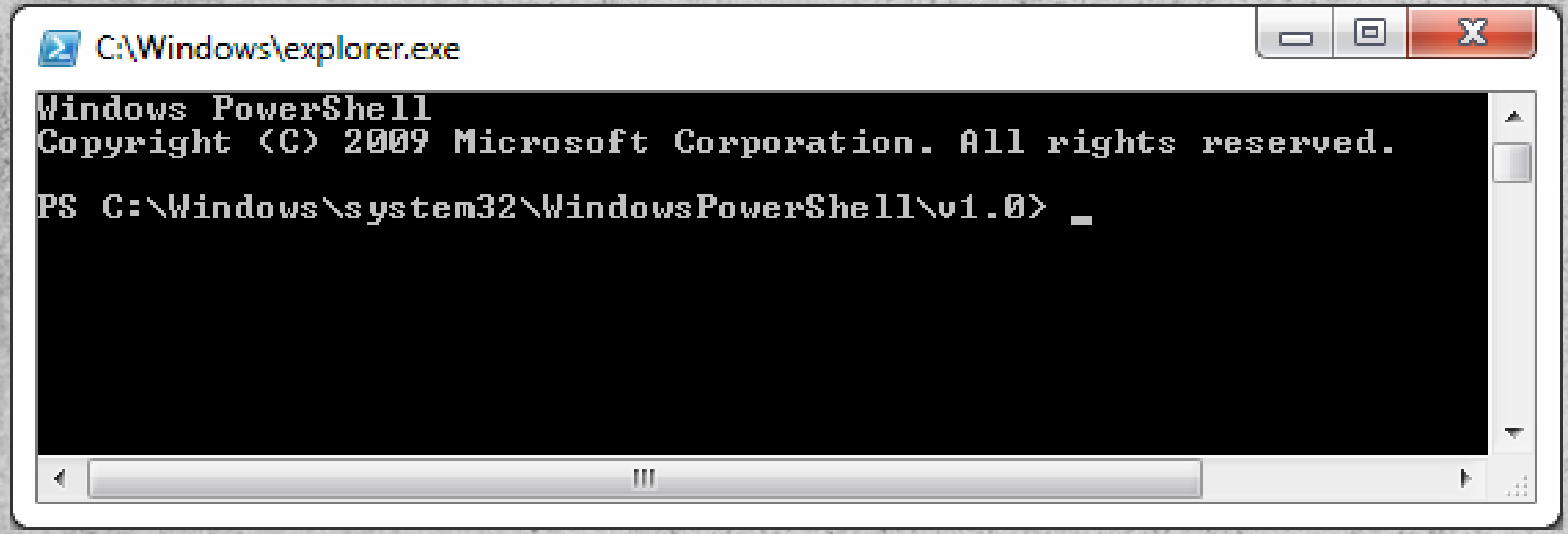
(1) Create junction folder: Evil.{deadb33f-aaaa-bbbb-cccc-dddddddddddd}

(2) Create HKCU entry to back our COM CLSID

|

|-> Lazy style, I wrapped this process in Hook-InProcServer

(3) Open folder -> profit!



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- Implement a full UAC bypass for C:\Windows\System32\eventvwr.exe
  |
  |-> Win 7,8,8.1,10,10RS1,10RS2

- Or "C:\Windows\System32\mmc.exe CompMgmt.msc"
  |
  |-> Win 7,8,8.1,10,10RS1,10RS2

- Or C:\Windows\System32\recdisc.exe
  |
  |-> Win 7

=> Oday's for everyone!
   |
   |-> Anyone MMC a pattern here?

Lab Time!

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Surely COM Objects Are fine!

- Look for low hanging fruit, lazy mode!

```
-> Get-ChildItem HKLM:\Software\Classes -ea 0|
    ? {$_.PSChildName -match '^\w+\.\w+$' -and (Get-ItemProperty "$($_.PSPath)\CLSID" -ea 0)} |
    ft PSChildName

-> New-Object -com "Some.Object"
```

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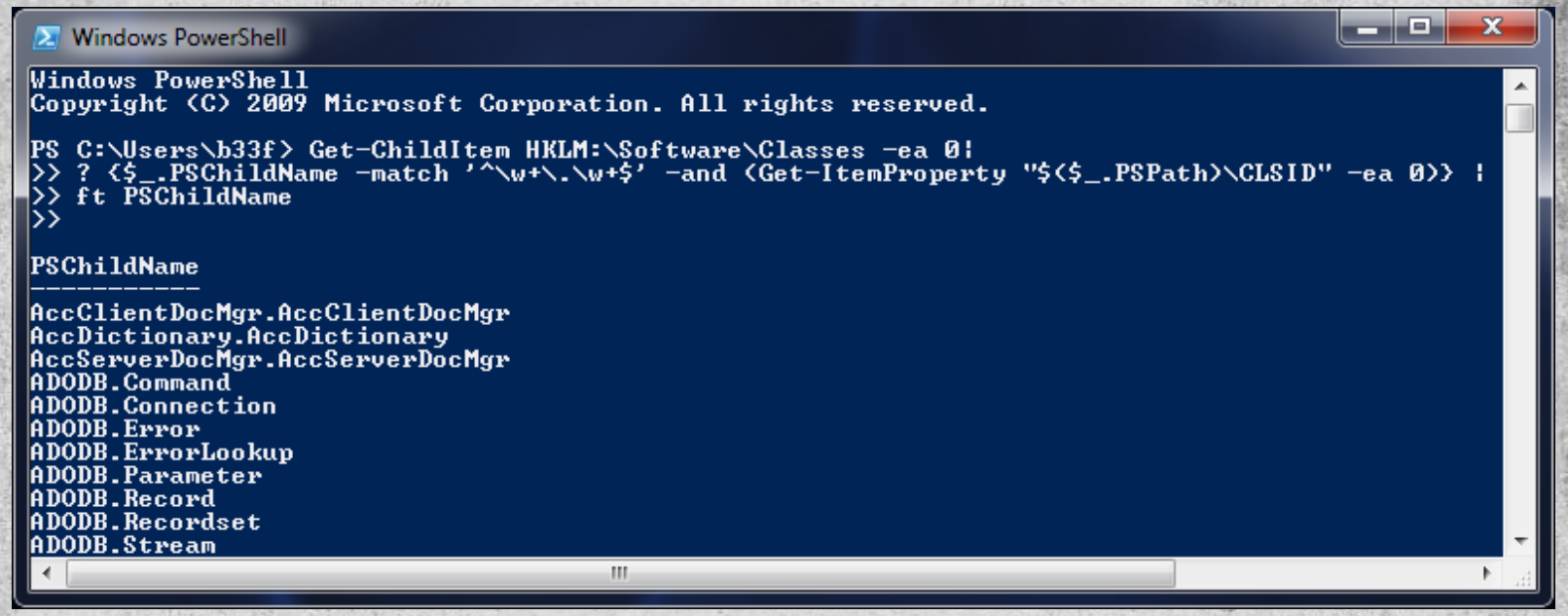
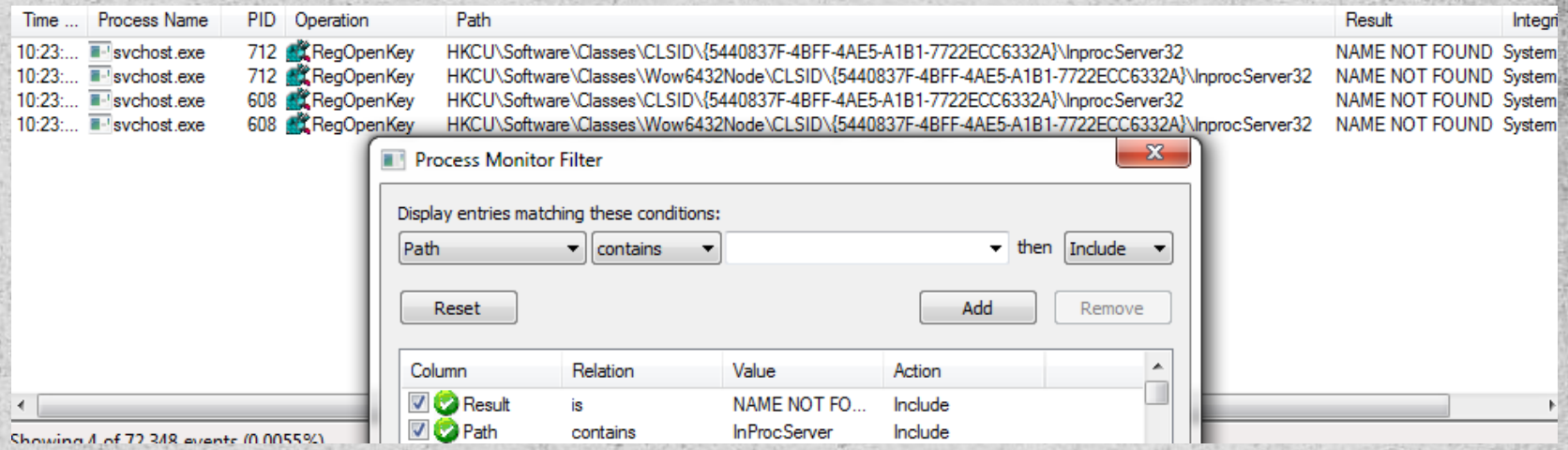
- Why don't we try the first one on the list?
|
|-> AccClientDocMgr.AccClientDocMgr (Win7)



=> Look familiar? You can't make this stuff up...



Think Again

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No Lab Time!

- No lab time for this, DIY at home, but ..... privesc Oday on Win7 WTF!
|
|-> Don't worry I asked MSRC and they won't fix it so we are free to abuse :p

- New-Object -com "ehRecvr.Recorder" (Media Center COM object)

ehRecvr.exe	2816	CreateFile	C:\Windows\ehome\ehETW.dll	NAME NOT FOUND System
ehRecvr.exe	2816	CreateFile	C:\Windows\System32\ehETW.dll	NAME NOT FOUND System
ehRecvr.exe	2816	CreateFile	C:\Windows\system\ehETW.dll	NAME NOT FOUND System
ehRecvr.exe	2816	CreateFile	C:\Windows\ehETW.dll	NAME NOT FOUND System
ehRecvr.exe	2816	CreateFile	C:\Windows\System32\ehETW.dll	NAME NOT FOUND System
ehRecvr.exe	2816	CreateFile	C:\Python27\ehETW.dll	NAME NOT FOUND System
ehRecvr.exe	2816	CreateFile	C:\Python27\Scripts\ehETW.dll	NAME NOT FOUND System
ehRecvr.exe	2816	CreateFile	C:\Windows\System32\ehETW.dll	NAME NOT FOUND System
ehRecvr.exe	2816	CreateFile	C:\Windows\ehETW.dll	NAME NOT FOUND System
ehRecvr.exe	2816	CreateFile	C:\Windows\System32\wbem\ehETW.dll	NAME NOT FOUND System
ehRecvr.exe	2816	CreateFile	C:\Windows\System32\WindowsPowerShell\v1.0\ehETW.dll	NAME NOT FOUND System

Any writable folder in the System path gives users a system shell

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Proxy DLL's

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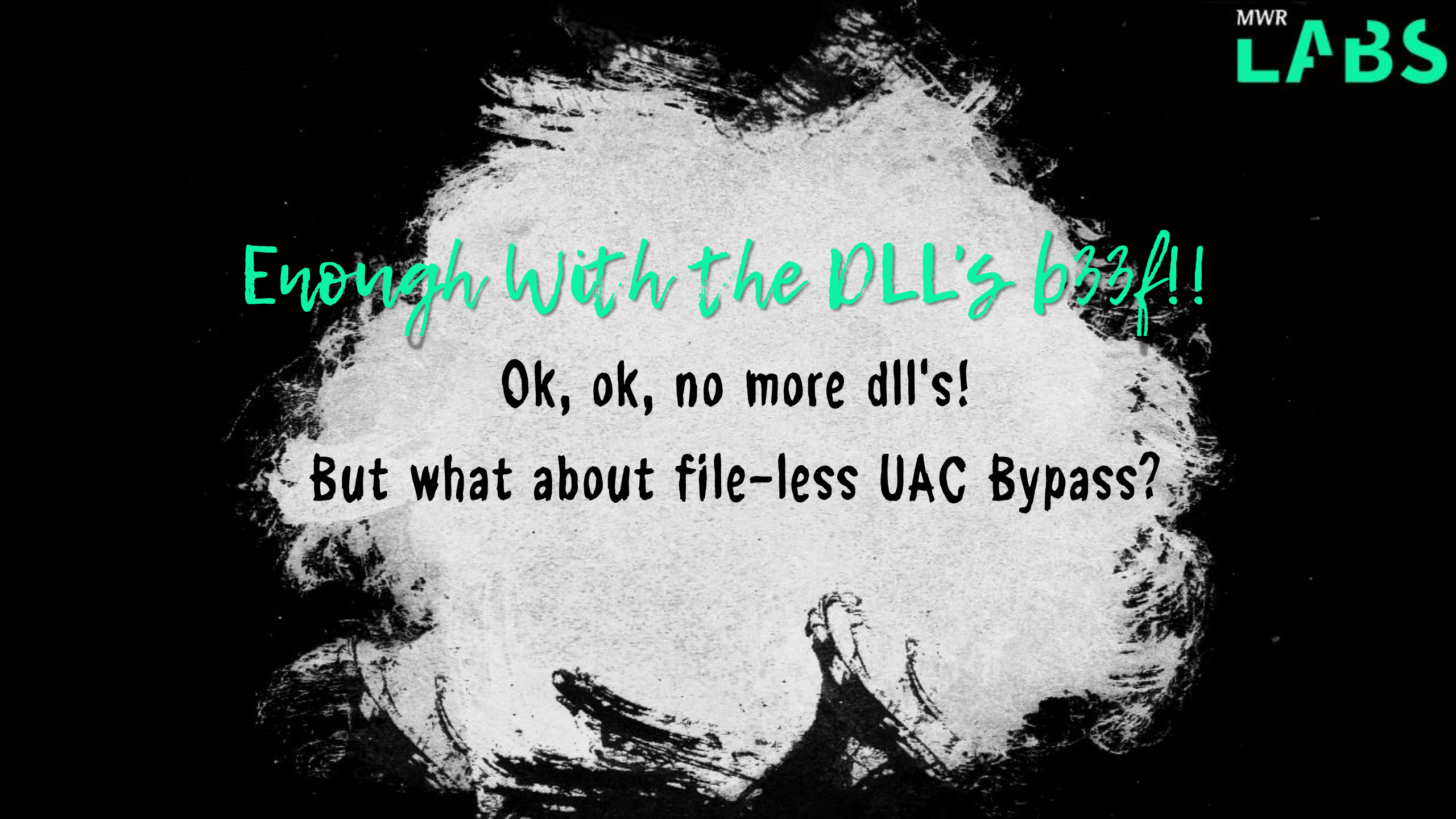
- We have been using a modified version of Fubuki by @hFireFOX
  - but what if you have to roll your own.
  - -> This was on the agenda but there are too many shellz and not enough time.

- Check out this awesome tutorial by @Cneelis!
  - -> http://uacmeltdown.blogspot.com/
  - -> You can use Get-Exports to extract C++ formatted code!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Enough With the DLL's b33f!!
Ok, ok, no more dll's!
But what about file-less UAC Bypass?

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ShellExecute -> LNK

- @enigma0x3, scourge of the west :D!
  - -> eventvwr: HKCU\Software\Classes\mscfile\shell\open\command
  - -> The Red Team loved this and so did malware!
  - -> Win 7,8,8.1,10

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- Try implementing a full UAC bypass using C:\Windows\System32\fodhelper.exe
  |
  |-> There is a small trick here, have a close look in procmon!
  |
  |-> Win 10,10RS1,10RS2

- Or C:\Windows\System32\CompMgmtLauncher.exe
  |
  |-> No tricks here
  |
  |-> Win 7,8,8.1,10,10RS1

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Environment Variable Expansion

Let's have a look at two case studies!

- C:\Windows\System32\CompMgmtLauncher.exe
  - -> %ProgramData% -> Computer Management.lnk
  - -> https://breakingmalware.com/vulnerabilities/command-injection-and-elevation-environment-variables-revisited/
  - -> Win7,8,8.1,10,10RS1

- schtasks /Run /TN \Microsoft\Windows\DiskCleanup\SilentCleanup /I
  - -> %windir% -> cleanmgr.exe
  - -> https://tyranidslair.blogspot.co.uk/2017/05/exploiting-environment-variables-in.html
  - -> Win 8.1,10,10RS1,10RS2 (Bypasses AlwaysNotify)

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There is much, much more...

However, why beat a dead horse aka shell fatigue!

Have a look at the following types in your free time.

- Race conditions
  |
  |-> https://enigma0x3.net/2016/07/22/bypassing-uac-on-windows-10-using-disk-cleanup/

- Elevated COM
  |
  |-> http://www.freebuf.com/articles/system/116611.html

- UIPI With uiAccess applications
  |
  |-> https://habrahabr.ru/company/pm/blog/328008/
  |-> https://github.com/hfiref0x/UACME/blob/5f578fcb7fa8b8f1d2fcfd3d159d004bdc709719/Source/Akagi/methods/hybrids.c#L1613

- NTFS reparse point
  |
  |-> https://github.com/hfiref0x/UACME/blob/5f578fcb7fa8b8f1d2fcfd3d159d004bdc709719/Source/Akagi/methods/hybrids.c#L1747

The straw that broke the camel's back

We will look at one final case.

This is based on an issue discussed/found by James Forshaw (& the CIA?).

Further reading in the posts linked below!

- https://tyranidslair.blogspot.co.uk/2017/05/reading-your-way-around-uac-part-1.html
- https://tyranidslair.blogspot.co.uk/2017/05/reading-your-way-around-uac-part-2.html
- https://tyranidslair.blogspot.co.uk/2017/05/reading-your-way-around-uac-part-3.html

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Split-Token Administrators Revisited

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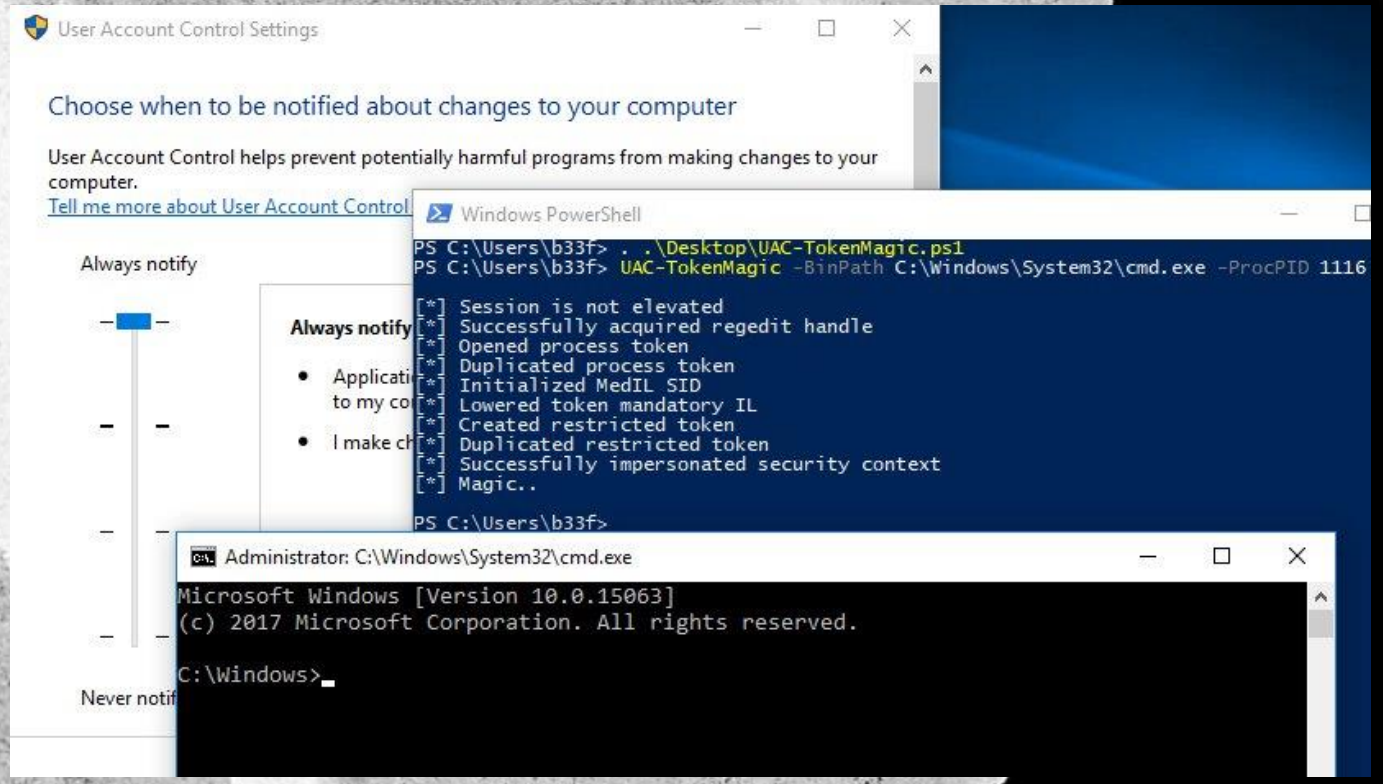
If we are part of the Administrator group & running with a Medium IL we can always bypass UAC. Even if the UAC setting is AlwaysNotify!

(1) Duplicate token of elevated process

(2) Lower it to Medium IL

(3) Remove some restricted groups & privileges

(4) Use CreateProcessWithLogon to spawn an elevated shell



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Game Over

"Perhaps it's finally time for Microsoft
to take UAC out the back and give it a proper sending off."
-James Forshaw

Reading Materials & Special Thanks

+ UACME project - @hfirefOx
  -> https://github.com/hfirefOx/UACME
+ Reading Your Way Around UAC (1&2&3) - @tiraniddo
  -> https://tyranidslair.blogspot.co.uk/2017/05/reading-your-way-around-uac-part-1.html
+ Exploiting Environment Variables in Scheduled Tasks for UAC Bypass - @tiraniddo
  -> https://tyranidslair.blogspot.co.uk/2017/05/exploiting-environment-variables-in.html
+ "Fileless" UAC Bypass Using eventvwr.exe and Registry Hijacking - @enigmaOx3
  -> https://enigmaOx3.net/2016/08/15/fileless-uac-bypass-using-eventvwr-exe-and-registry-hijacking/
+ Bypassing UAC on Windows 10 using Disk Cleanup - @enigmaOx3
  -> https://enigmaOx3.net/2016/07/22/bypassing-uac-on-windows-10-using-disk-cleanup/
+ Bypassing UAC using App Paths - @enigmaOx3
  -> https://enigmaOx3.net/2017/03/14/bypassing-uac-using-app-paths/
+ Anatomy of UAC Attacks - @FuzzySec
  -> http://www.fuzzysecurity.com/tutorials/27.html
+ Windows 7 UAC whitelist
  -> https://www.pretentiousname.com/misc/win7_uac_whitelist2.html
+ Inside Windows Vista User Account Control - TechNet
  -> https://technet.microsoft.com/en-us/library/2007.06.uac.aspx
+ Inside Windows 7 User Account Control - TechNet
  -> https://technet.microsoft.com/en-us/library/2009.07.uac.aspx

.....And many many more!.....

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Questions?

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